AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

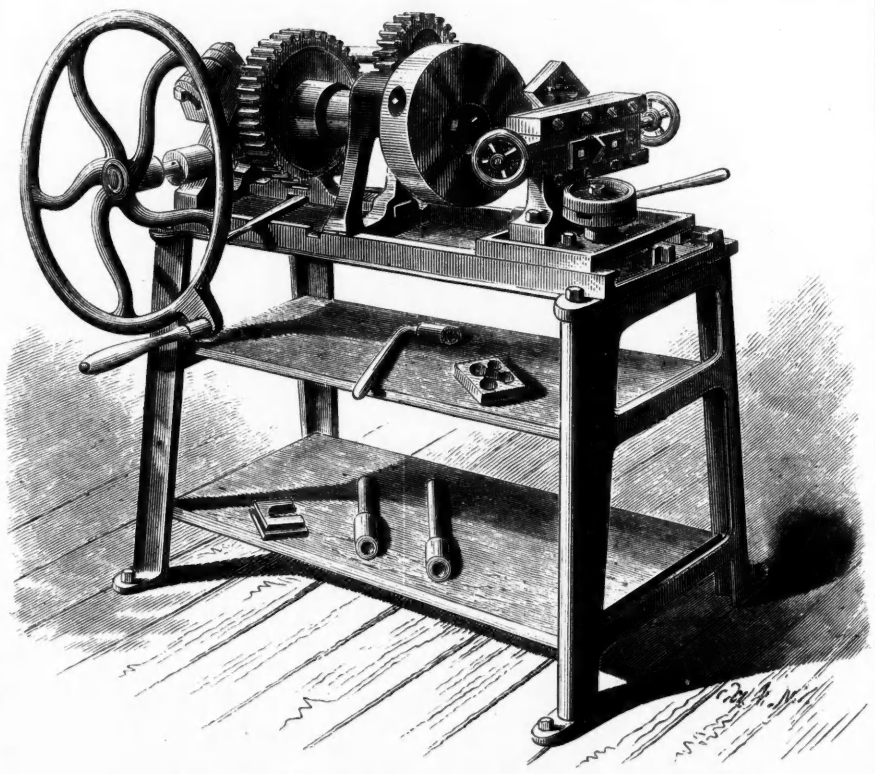
Entered at the Post Office at New York, N. Y., as Second-Class Matter.

VOL. 2, No. 13.] NEW YORK, SATURDAY, AUGUST 2, 1879. [$3.00 per Annum.
SINGLE COPIES, 6 CENTS.

Improved Pipe-Cutting and Threading Machines.

We illustrate on this page two machines for cutting and threading pipe which possess special features of merit.

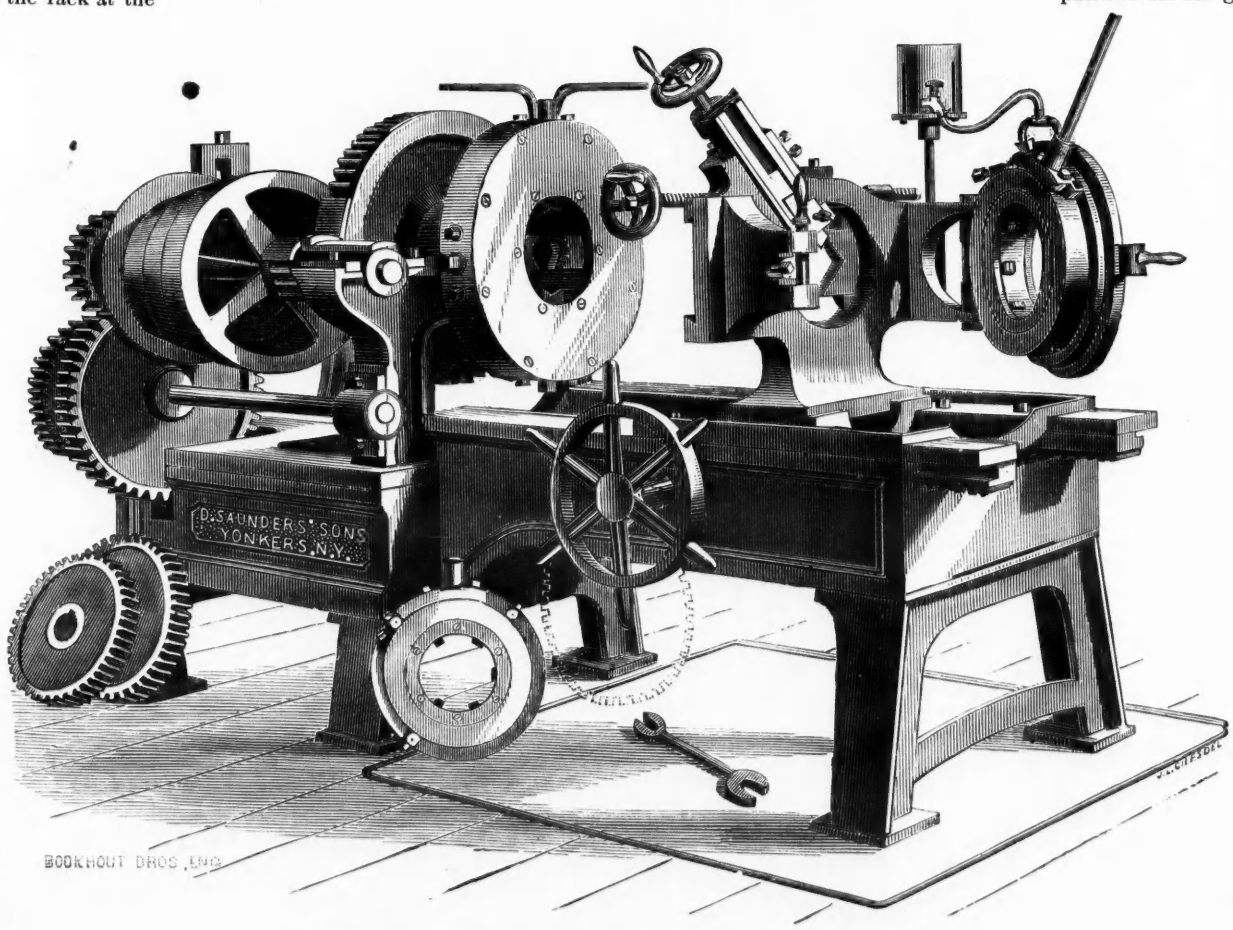
The small machine (shown in the upper cut) is designed especially for hand work, but can also be used with power. It is simple in construction, easy to work, not liable to get out of order, and does not require skilled labor to run it. The arrangement of the gearing permits of the machine being adjusted to the work to be done, enabling one man to screw a two-inch pipe with ease. There are three changes of speed: the fast speed cuts ¼, ⅜ths, and ½; the next, ¾, 1, and 1¼ inches; and the slowest 1½, and 2 inches The changes are made by the movement of the lever in front of the machine. The patent concentric gripping chuck is of substantial construction, having three jaws moved to the center by one screw centering the pipe true. This chuck is a superior device for gripping pipe. The machine is provided with a novel chuck on the back end of the spindle, for entering the pipe, doing away with guides. The die-head is arranged with cutting-off, tool-slide, and self-centering jaws for steadying the pipe while being cut off. The die-starter is the long lever-working pinion in the rack at the bottom of the die head.



SAUNDERS' TWO INCH PIPE CUTTING AND THREADING MACHINE.

It is a portable machine, weighing about four hundred pounds. Crooked threads cannot be cut, as the pipe revolves, and the die stands still. There are no loose guides to be changed or lost. The machine can be easily arranged to operate by belt power when desirable.

These machines are made by a system of duplication of parts, the same as firearms and sewing machines, which enables any part that requires replacing to be duplicated at once, as soon as the order is received at the factory. It also insures a better fitting nut, and more accurate construction, and, at the same time, permits the manufacturers to offer them at much lower prices than machines built upon the old-fashioned system of filing and scraping to get the parts of each machine joined together in working order. It is claimed that one of these machines costs very little in excess of what is required to be paid for a set of stocks and dies, cutting the same ranges of sizes with the necessary cutting-off tools and pipe vise. It will, undoubtedly, to a great extent supersede the last mentioned tools, especially in the shop or on a job of some extent. It will be found very serviceable in machine and jobbing shops for cutting off round iron and steel, and, with the bolt-threading and nut-tapping attachment, it makes a very good bolt-threader and nut-tapper. This machine has a capacity for making nipples from one-quarter to two inches. The attachment for threading bolts and tapping nuts has a capacity to 1¼ inches. By the use of this machine a large amount of labor is saved, it being found much easier on both dies and pipe, also on the workmen, than the ordinary way of cutting and threading.



SAUNDERS' EIGHT INCH PIPE CUTTING AND THREADING MACHINE.

The cut on the lower part of the page represents a machine that screws and cuts off pipe from 2¼ to 8 inches. It is designed for heavy work or where a large amount of pipe work is to be done. The cut shows a number 6 machine. The others (five sizes in all) are of similar construction. The special advantages of these machines are summarized as follows:

1. The belting and gearing of the machines have been arranged with the view of obtaining suitable power and speed for the various sizes of pipe, so that the small sizes of pipe will revolve the same number of feet per minute as the larger.

2. The power of the machine is in the arrangement of the gearing, avoiding the necessity of using large pulleys and tight belts, a difficulty common in such machines.

3. Besides the variations of speed obtained by the cone pulleys, two pairs of gear wheels which are very readily changed on the end of the frame will give the required speed and power for the sizes to be cut.

4. The die and head to which it is attached are so constructed that pipe may be alternately screwed and cut off without removing the die from the machine, by swinging it back, as shown in cut. The cutting-off tool is convenient, and out of the way. The steel dogs, for steadying the pipe while cutting it off, are moved by right and left screw, thereby centering the pipe truly. The dogs are adjustable, so as to compensate for wear.

5. The chuck for holding the pipe is strong and well fitted, and provided with independent dogs, permitting of the adjustment of the pipe to the center, and avoiding a common difficulty in the ordinary pipe chuck after it has been used some time.

6. Great care is exercised in making the patterns for the gearing, which is cast from iron patterns, cut in approved shape of teeth and thereby the manufacturers have succeeded in making these machines run almost noiselessly.

7. These machines, when arranged for tapping large fittings, are provided with extra gearing for moving the chuck as shown by dotted lines.

The machine is fitted with a patent die, which opens so that it may be taken off the pipe without stopping or reversing the machine. They are adjustable, and can be enlarged or reduced, as may be required, in a few minutes.

These dies do not require to be moved from their place while cutting off the pipe, as they expand to allow the pipe to pass through into the guide in the cutting-off head of the machine. The cutters can be taken out and sharpened by grinding; when too much worn, they can be recut and retempered, and used again.

They effect a great saving of time, with no possibility of stripping the thread, as is frequently the case with solid dies. The improved die, it is claimed, will screw double the amount of threads compared with any solid die, before need of grinding. These dies are carefully fitted by milling, planing, and turning to steel gauges, thereby enabling the cutters or any other part to be duplicated, also old cutters to be recut without the die-block they fit into.

These dies have become very popular on account of their rapidity and ease of action, uniformity of the work, their simplicity and durability. They can be used on any machine for cutting and threading pipe. They are made from ⅜ths to 8 inches and larger to order. These machines are manufactured by D. Saunders' Sons, Yonkers, N. Y., who have, for several years, made an exclusive specialty of both hand and power tools for cutting and threading pipes and tapping fittings for pipe. They have sold the large machines to a number of manufacturers of wrought iron pipe, also to the principal steam heating establishments in New York, Boston, Chicago, Cincinnati, St. Louis and other cities, also the leading oil refineries, in all of which they give general satisfaction.

Krupp's Car Wheels.

The engraving represents a new mode of securing the tire to car wheels, which has been in use for some time in Europe and is now being introduced into this country. Our engraving shows a section of a car wheel with tire attached, and gives the sizes of the different parts intended to be used in practice.

The cast-iron center, or wheel, is to be turned to the required size, the tire bored so as to make a shrinking fit. There are two wrought iron retaining rings placed on the sides of the wheel, with a bolt through them at the end of each spoke. These rings have a groove in the side which fits over a projection on the edge of the tire, the object of this device being to secure the pieces of tire when broken, thus preventing an accident. There are wheels now running in Switzerland on which the tires have been purposely cut in sections to show the advantages of this invention, and are said to have run over a year. Another advantage claimed for this device is that the tire has a greater amount of material to wear away; the tire when new is to be 3¼ inches thick, and can be worn down to one inch, and even less, in thickness without the danger of accident, which is necessarily encountered in some other kinds of wheels. The tire is extended beyond the sides of the wheel to ensure the required width of face, and, it is claimed, with equal safety.

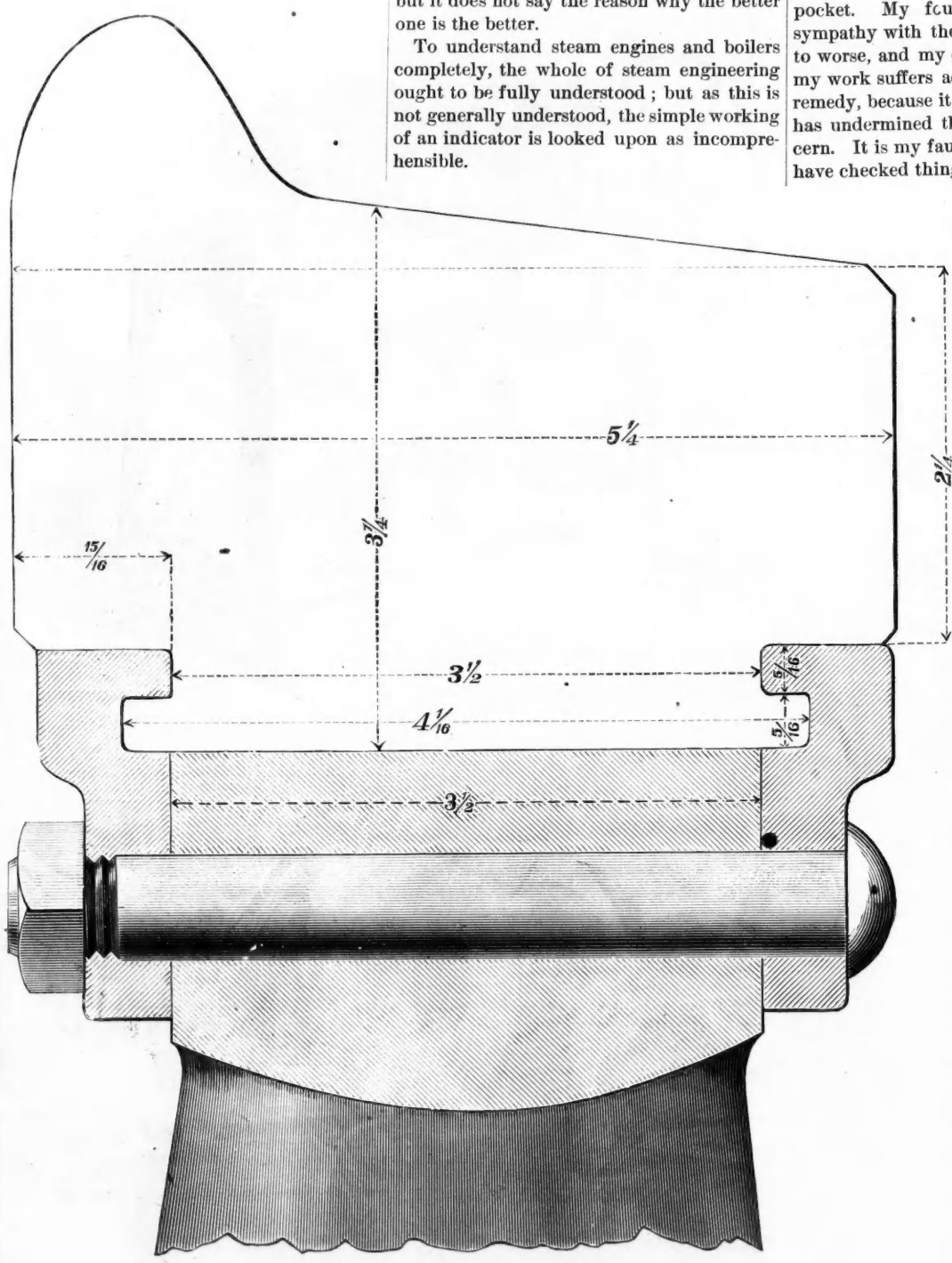
When the face of the tire gets worn hollow, it is to be turned true to the former shape. The manufacturers claim that this style of wheel will run 500,000 miles, and at the end of that time all that is necessary is simply to replace the worn out tire by a new one. This device applied to a wheel made of wrought iron ran 300,000 miles, and it is claimed will do better on centers made of cast-iron with hollow spokes. This wheel was designed to take the place of the chilled cast-iron wheels, and is imported by Thos. Prosser & Son, 15 Gold street, N. Y., who are prepared to furnish the following sizes, viz.: Outside diameter of wheel-inches, 26, 28, 30, 33, 36, 40, 42. These tires are made of the best crucible cast steel, and the workmanship is too well known to need further comment.

Is the Indicator a Miracle?

To speak in common terms about an indicator and consider it equal to any other device in steam engineering, as a steam or water gauge, etc. is probably not pleasant for many of our engineers who often make much mystery in this little instrument. Parties making a specialty in using the indicator, like to represent it in the eyes of people as important as possible; sometimes they figure on the hundredth part of a drop of water, in one or the other corner of a diagram.

By all this, it is kept above the level of common practice, high in price and only a very little applied, compared with the advantages it has; although its application is simple and its duty for general purposes easily understood. In this, as with many other devices, if it is not clearly understood, people will look for secrets and, if they see it is conducive to some valuable end, will pay an undue respect to its supposed mysterious attributes, which disappear as soon as the scales drop from their eyes. So with some good workmen not familiar with steam engine work; they struggle and do not consider a cross-head, connecting-rod, etc.—like any other piece of machinery, which only requires good workmanship—because they are under the excitement that *it is for a steam engine.*

The good condition of every engine sold, ought to be, and will in the future be, proved by an indicator diagram, showing the correct working condition of the distributing steam valves, and as a supplement to this, an engine should show, by aid of a dynamometer, the useful power due to the quantity of coal burned; this will correct and show precisely if the valves arranged and set on an indicator



Section of Krupp's Car Wheel.

are correct and in harmony with the real available power found by the dynamometer. Cards should be taken while the engine is doing hard work, as well as while running idle, as cards then often show quite different results

The indicator is corrected by experiments on the property of steam—What corrects the dynamometer? If one engine shows a diagram better than another one of the same size, but cannot come up practically to its diagram power shown, what is the reason? The indicator and dynamometer ought to assist each other.

What does an indicator diagram tell us? To speak radically—only the sinking and raising of pressure inside of a steam cylinder. Whether this pressure is caused by steam or water, the indicator does not prove, nor do we know. We can say a certain pressure means so many degrees of heat, and it requires a certain amount of coal and water to make it. Experiments on this point are made most every year, with different styles of boilers, which no doubt are very costly; but special experiments with reference to certain properties of steam, which could lead us to a better understanding of the whole matter, clearly and practically, are not made. Such experiments as are made, are kept enclosed in such a cloud of algebraic formulas that they are not understood in the work shops, where boiler and most of the steam engines are built, and are so of little or no value. If we know, so much coal is required to evaporate so much water, in so many miles a locomotive runs, and that another one runs with less or more coal over the same grade, the same distance with the same load, is only a practical proof that one or the other type of locomotive is the better; but it does not say the reason why the better one is the better.

To understand steam engines and boilers completely, the whole of steam engineering ought to be fully understood; but as this is not generally understood, the simple working of an indicator is looked upon as incomprehensible.

In general, the use of an indicator relates only to the arrangements and setting of steam valves. There is much written and said about indicators and diagrams, but a very little about steam itself and its properties.

In compressing the steam or vapor before the piston reaches the end of its stroke, in what condition is this vapor?

So with steam carried to a high degree of expansion and using a condenser. Which is the best plan—to work steam—rapidly or slowly? How does steam move through water—easily or with difficulty, and what helps it in passing through water? How does the working capacity of steam change while doing work? Should a steam engine be built to suit the properties of steam, or must the steam behave to suit to the designer's plan of his steam engine, etc., etc?

These are all questions which ought to be closely investigated with practical experiments, and if all this is well understood, it will make the working of an indicator perfectly clear, and will make us acquainted with many events an indicator does not show.

Brooklyn. Herman T. C. Kraus.

Extracts from Chordal's Letters.

* * * Is there any essential connection between a machine shop and a foundry? If I start a shop up in Saugerties I will soon find that I have trouble in getting castings. Competitors won't make them for me, or they don't run a heat often enough, or something of that kind. I find myself compelled to start a foundry of my own. I do the best I can of course, and try and get good castings out of this little foundry of mine, but if I get bad castings into the machine shop I study a long time before breaking them up, and often I finish up castings which I feel ashamed of, because their reparation or replacement rather comes out of my own pocket. My foundryman, while in full sympathy with the situation, goes from bad to worse, and my castings get fearful and all my work suffers accordingly. It is hard to remedy, because it has crept on gradually and has undermined the constitution of the concern. It is my fault, of course, and I should have checked things at the start, but I know full well that such a course would involve the employment of a high-priced man in charge of a two-cent foundry, and also that this little foundry would needs be equipped with all the accessories belonging to a big concern. Then, again, the work is mixed in character and my foundryman tells me so. Some little work, some heavy work, etc. etc., and not enough of either kind to justify the employment of moulders skilled in a single specialty. The same with the iron. He tells me he can't make all kinds of castings out of one kind of iron, and can't afford to melt up a pound or two of iron for a special job. He convinces me that the fault does not lie in his lack of skill, so much, as in the general and unavoidable circumstances. I feel convinced of the truth of the thing, and come to the conclusion that it often requires more skill to run a little foundry than a big one. Nevertheless I am compelled to work up horrible castings, and finally I am forced to add a brass furnace. Now I have done it. I have got to have brass castings but can't afford to keep a brass moulder or founder. I must have different kinds of brass in a fifty pound heat, but they must all be poured out of one pot. Of all the scientific manipulation of alloys in one crucible you have a sample.

If machinists have a God I pray him to protect and deliver me from contact with brass castings made in an iron foundry So much for my small business in Saugerties. If I had a big concern I could and would do differently. I would have heavy moulders and light moulders, and a loam floor and snap flask men, and two or three big cupolas and a little one, and a big brass furnace with ten crucibles cooking all the time, and good brass moulders working in good brass sand, and pickling vats, and annealing ovens and I don't know what all, and when I found I was able to pay for my whole business on this scale I might possibly conclude that I was too well fixed financially to need a shop at all. Bad as my ideal experience has been in Saugerties, I know that no small shop with all the arts combined in one machine has done any better. Their castings are as rough and as hard when they ought to be soft, and as soft when they ought to be hard, and not in exist-

ence at all when they ought to have been cast last Friday, etc. But happily I am not going to Saugerties to go over the same ground I have fought over before. Instead of that I am going over to Newark to start a shop, a machine shop by the way, and this whole subject is brought up by the question as to whether or not I shall want to build a foundry. I will want big castings and little ones, hard and soft, nice and true and smooth without regard to cost, and cheap without regard to shape or surface or strength, and brass castings yellow and white, for finishing and for dipping. What manner of mill would I erect which could economically deliver small grists of this metallic medley? What's the use of building any? One block one way I can get heavy castings, every day, at a price

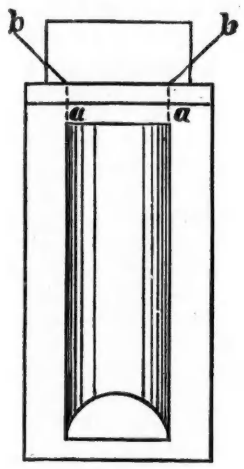


Fig 1

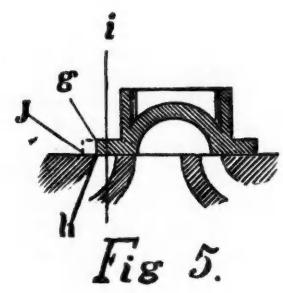


Fig 5.

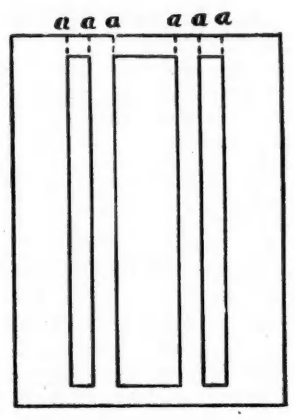


Fig 2.

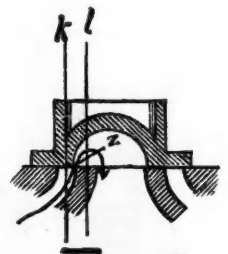


Fig 6.

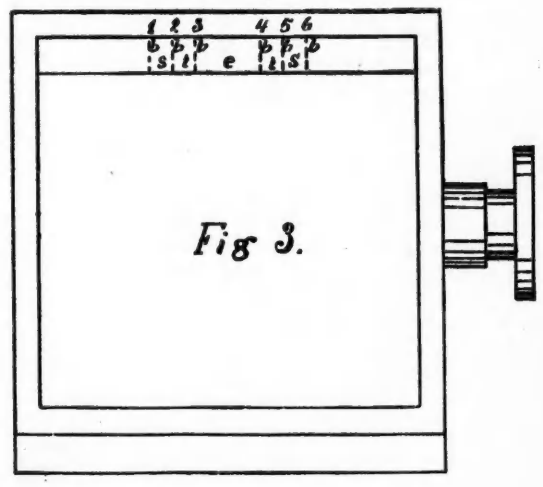


Fig 3.

I blush to name; one block the other way I can get annealed small castings fit to build a watch of, and two blocks in every direction I can get brass castings, every hour, of every alloy. And the best thing about it is that these castings will all be first class or I won't take them; and these men know it, and have been caught once, and will never send me doubtful castings.

Castings made by the user tend to degenerate in quality all the time, and castings delivered subject to acceptance tend to improve in character all the time. But O'Brian stops me in my attempts to reach the truth, and tells me he made more out of his little foundry last year than he did out of his machine work; and I tell O'Brian that Dunkerley made more out of his little machine shop than O'Brian did out of his shop and foundry both; and the joke is, that he bought his castings of O'Brian, who has to acknowledge that the only good castings he made were those he sold to other shops

During my inquiry it occurs to me that I am a machinist and not a foundry-man, and that if I am tempted to add another trade to my establishment, I would do much better by making good stomach bitters for other folks to use than to make bad castings for myself to use. There's more money in it and it don't take up so much room, and besides that, my excuse for a lazy drunkard with a slouchy wife, or for a smart young chap who dresses and lives proudly, but there is none for you. I never saw you with nice clothes on, and never saw you and your family out enjoying an evening at a theatre, or any other place, and I will bet a quarter you buy heavy sugar at higher price than sawed block, and pay more for coal oil than I do, and pay more for your clothes. You get good pay—a blamed sight better than I do, and I am bound some one around this place shall make some money. If you and your wife, after studying common sense for a year, can't show me a certificate of deposit for three hundred dollars, you shall earn your butterless bread in somebody else's shop. Mack said nothing, and went into the shop again, but Sackett didn't stop. Half of them are idiots, said he, just like Mack. He will go and buy a miserable coat of the Jews for eight dollars The coat don't fit him, and would take the pride out of any man who ever lived, and I will wager he has bought six of them since I paid twenty-five dollars for the one I have on. I expect the same judicious plan is followed in all the family expenses. I can see why a drunkard don't save money, but why McMillan and his wife can't save money on three dollars per day I don't understand. If I should raise his pay to six dollars he would not live any better or save any more money, Chordal, I tell you, some of the men in the shops make me sick. I hammered three thousand dollars out of the trade as a jour before I set up shop myself, and I never got rolls, &c., and showed McMillan that he had received and spent more money in the last twelve years than any small store-keeper in the whole town could possibly have made. Mack couldn't say anything, but it made him feel rich to see what money had gone through his fingers, and awful poor to see what had not stuck to them. Sackett got mad as he thought of the thing, and finally told Mack he could not draw any pay, but he would lend him ten dollars for a week; but mind you, added he, I am going to make an example of you. There's some three dollars a day in my life; but I didn't save my money by wearing Jew coats or washing myself with soft soap, and I went fishing once in a while without fear of starving Mary and the girls.

The working-men's millennium will come when some man will drop among them and teach them common sense about money matters. As soon as this benediction or malediction, or whatever you may call it was over, I left Sackett's place without disposition to argue against known facts. * * *

Very Respectfully, CHORDAL.

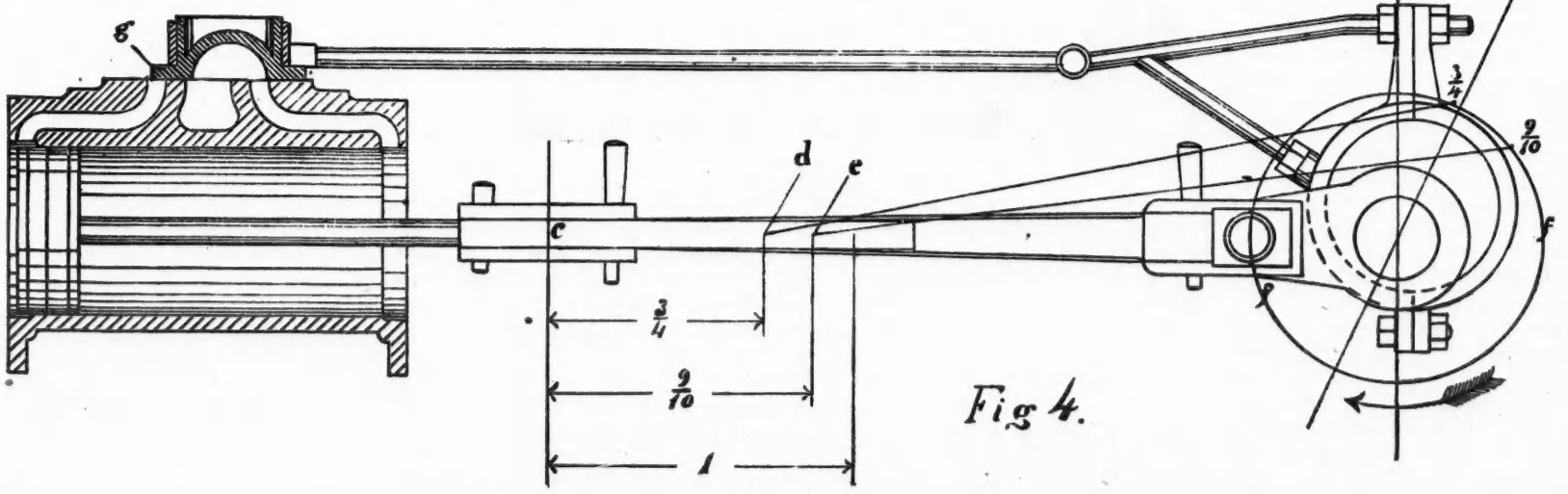


Fig 4.

Re-modeling Valve Motions.

Editor American Machinist:

In plain slide-valve stationary engines, that is, engines without automatic or variable cut-off attachments, it frequently occurs, especially in engines built years ago when the functions of the slide-valve were less perfectly understood, that the valve is so improperly designed as to cause numerous troubles in the engine, not the least of which is a wasteful use of steam.

The writer, having frequently been called in as an expert to detect the fault with wasteful engines, has so frequently found the chief cause to be badly proportioned valves, that he proposes in this article giving his mode of remedying the same, as he has by this means frequently made savings of from ten to thirty per cent. in the item of fuel.

The plan is to make the engine itself act as a model, and has frequently been used on locomotive as well as stationary engines. It is first necessary to remove the steam chest cover and take out the valve. A straight edge is then placed fair with each edge of the exhaust cavity of the valve, and two lines drawn outward to the end, as shown in Fig. 1 at *a a*. These lines are squared across the end to *b b*, and then toward the cavity on top of the heel of valve, immediately over and parallel to *a a*. Similar lines are drawn on the valve-seat from each edge of the three ports, as at *a a a a a a*, Fig. 2, and then lines extended up on the inside of chest as at *b b b b b b*, Fig. 3. The valve is now to be replaced and coupled up with valve-stem. The engine is then placed on either center—say the forward one, as shown in Fig. 4. The valve should then occupy the position shown, (the device shown by which eccentric is connected to valve-stem is sometimes used to do away with rocker-shaft and retain strength at valve-stem) as the crank follows direction of arrow, and piston travels from left to right, the valve will also travel from left to right during the first half of piston stroke. It is generally conceded by engineers, and has been the writer's experience also, that the most favorable point of cut-off, all things considered, with the plain slide-valve, is at $\frac{3}{4}$ of the stroke, and that the proper point for the exhaust to take place is at $\frac{9}{10}$ of the stroke, on engines running 500 piston feet and under per minute. After the cross-head has traveled $\frac{3}{4}$ of the stroke, (the engine being turned by hand) that is, when the point (center) *c* on cross-head, Fig. 4, has reached *e*, ($\frac{3}{4}$ of the stroke) remembering to turn the engine in the direction it runs, the position of the valve should be noticed. It was previously stated that during the first half of stroke of piston, the valve traveled from left to right; during the second half, the valve, having opened the port to its fullest extent, recloses it, traveling from right to

left. When the point c^1 has arrived at c, (any other point on the end of cross-head can be taken, the point c being changed to correspond), the edge of valve, g, Fig. 5, should have just come, line and line, with outside edge of port h, same figure. If the valve's edge does not occupy this position, but should have over-traveled, as shown by dotted lines j, the valve cuts off too early, which leads to a distorted action, closing the exhaust port too much. The remedy is to cut off that portion of valve which overlaps. This condition the writer has never found in practice. The writer does not mean to assert that the plain slide-valve cannot *be made* to cut off closer than ¾ of the stroke, without especially distorting the valve's action, but the amount is so small and necessitating the enlargement of the ports in width, and consequently the valve, with the attending evil of excessive valve surface exposed to pressure, that the writer believes that ¾ of the stroke should not be exceeded by the valve alone and unaided by special cut-off devices. If, as is often the case, the valve's outside edge, when cross-head is at ¾ of its stroke, should not have closed the port, but should leave it open, and the edge of valve be in line with —say the line $i\,i$, Fig. 5—the valve cuts off too late, and should have its lap on both ends increased by just the amount it lacks of just closing the port. Whatever is cut off or added to either end, should be cut off or added equally to the other end.

To get at the point of exhaust it will be necessary to make use of the lines mentioned in first part of this article. Move the crosshead by turning engine till it has traveled $\frac{9}{10}$ of its stroke (till c corresponds with e). The valve is now moving from right to left, and should occupy the position regarding the ports shown in Fig 6; that is, the edge of exhaust cavity Z should stand line and line with inside edge of steam port, as shown; that is, the line $a1$ on valve, which is on the left hand side of valve when valve is on valve slot, as shown in Fig. 3, should compare with line $b2$ on chest, which corresponds with inside edge of steam post. At this point the exhaust is just opening for the escape of steam; as shown by arrow in Fig. 6. Should the edge of valve, when cross-head is at $\frac{9}{10}$ of its stroke, occupy the position of line KK, the exhaust opens too soon, and should have the amount that it opens port at this point added to both edges of the exhaust cavity. On the chest this condition will be shown by the line $a1$ on valve standing to the *left* of line $b2$, and between lines $b2$ and $b1$. If, on the other hand, the edge of valve cavity Z should stand on a line with line LL, Fig. 6, the exhaust opens too late and should have the amount it lacks from coming line and line with inside edge of steam port cut out of both edges of cavity of valve. By the lines this condition will be shown by the line $a1$, on valve standing to the *right* of line $b2$ on chest and between $b2$ and $b3$, ss in Fig. 3 being steam ports, as represented by the lines, and tt the bridges and e the exhaust port.

However, the amount cut from exhaust cavity should never be enough to make width of cavity *exceed* the distance between the two inside edges of steam ports, or the distance X, Fig. 2. This would allow a passage from end to end of cylinder at the moment valve passed the center line of ports, and, although used by some engineers (?), it is bad practice, and is, at best, a mistake to correct a mistake. The writer assumes in above that the outside lap, as ascertained by this mode, never exceeds the width of steam port, that the exhaust port is twice, or nearly so, the width of steam port, as, under their conditions, if the bridges are nearly equal in width to the steam port (as they generally are) and the throw of eccentric is sufficient to open steam port; fairly open, the exhaust port, at its minimum opening is half open to the escape of the exhaust. Hence, as this opening is equal to the steam port in area, the exhaust can never be cramped. The compression will not be found to be excessive, but sufficient to take up all lost motion. Very little lead should be given. The closing of the exhaust can be found by the lines. If the exhaust cavity is "line and line" with inside edges of steam ports, compression and release are simultaneous. Where an engine is hard pressed for power occasionally, it will be better to proportion value as above and speed up engine instead of increasing power by carrying steam to a greater portion of the stroke, with the liability of a cramped exhaust, the reduction of outside lap necessary to carry steam farther giving a reduced exhaust lead and choked exhaust. Where outside lap is added to a valve the throw of eccentric must be increased the same amount, unless travel of valve can be augmented by other means. In most cases, the cheapest plan, after ascertaining the new proportion of valve, will be to make a new valve instead of patching up an old one, remembering to ascertain first if the size of steam chest will admit of an increase of valve's travel.

V. HOOK.

Self Feeding Ratchet Drills.

Of the number of self feeding ratchet drills that are manufactured at the present time, few have come up to the requirements of such a tool. It is claimed by the inventor of the ratchet represented in our illustrations, that this has been a successful attempt to construct a ratchet that combines simplicity, efficiency, and durability,

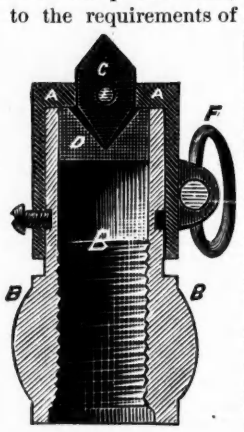


FIG. 1.

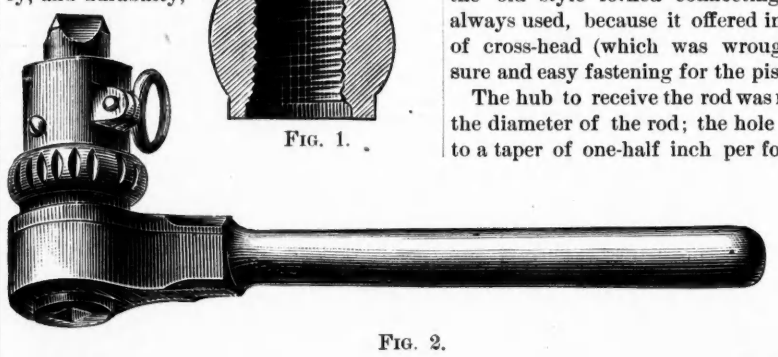


FIG. 2.

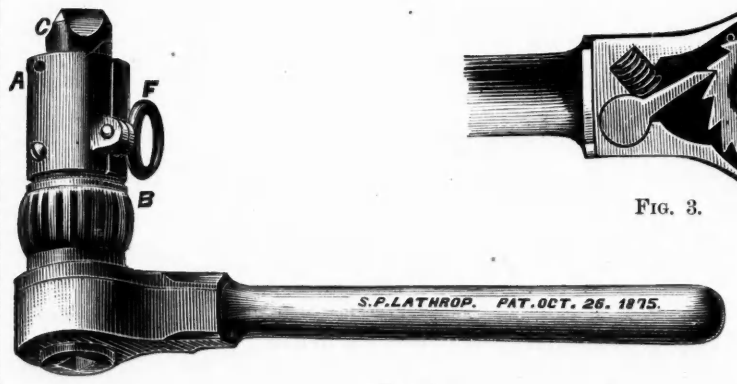


FIG. 4.

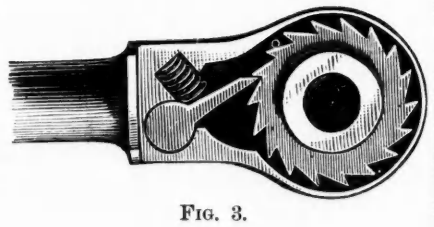


FIG. 3.

with a perfectly reliable and powerful self-feed, capable of being instantly adjusted to any required cut, and equally adapted to the lightest, as well as to the heaviest work. This, the inventor claims, has been obtained by a novel combination, at once simple, and certain in its operation, and by the use of which we are enabled to perform a given amount of work, in a great deal less time than it can be done by many other ratchet drills now in the market.

The general construction of this ratchet is of such a nature as to insure great durability; and is capable of doing very heavy with the same certainty of operation as on light work. Referring to Fig. 1, we will describe the self-feeding device, and its operation.

The inside or feed sleeve B, also shown in Fig. 4 at B, which screws upon the drill spindle, is fitted with a friction or outer sleeve A, in the head of which is secured a steel chisel-shaped pin C, the lower end of which is pointed and rests upon a hardened steel-bearing D, fixed in the head of the inner sleeve B. This sleeve, with its bearing D, revolves upon the point of the pin C, and within the friction sleeve A. Having thus described its construction, we will now describe the operation of the self-feeding device. The head of the pin C being chisel-shaped, prevents the pin and the outer sleeve A from revolving. If the thumb, or friction screw F, is unscrewed, it will permit the inner sleeve B to rotate freely upon the bearing of pin C, and within the friction sleeve A. As the screw F is tightened, the friction upon the inner sleeve B is increased, causing it to remain stationary, and consequently causing the screw on the drill spindle to feed the drill, until the friction on the drill becomes greater than the friction on the sleeve B. This then commences to rotate again within the outer sleeve A, and continues until the chip, which the drill has commenced to cut, is finished, when the same operation is repeated, thus giving a continuous feed, capable of being instantly adjusted to feed fast or slow, as desired, by tightening or loosening the friction screw F, thereby causing a greater or less friction upon the inside, or feed sleeve B.

Fig. 2 shows a pattern designed for short work, where the size shown in Fig. 4 could not be used. Fig. 3 shows the construction of the paul, spring, ratchet, and their application. Four sizes of these ratchets are furnished for general work, and two sizes for boiler makers. They are manufactured by S. Park Lathrop, 200 Market St., Newark, N. J.

Engine Proportion and Construction.

THE SECURING OF PISTON-ROD TO CROSS-HEAD.

Editor American Machinist:—

In the early days of the horizontal engine, the old style forked connecting rod was always used, because it offered in the form of cross-head (which was wrought iron) a sure and easy fastening for the piston-rod.

The hub to receive the rod was made twice the diameter of the rod; the hole was bored to a taper of one-half inch per foot, and the length of hub was three times the diameter of rod The rod was turned at the end to an accurate fit for the taper in cross-head, with thread on extreme end. It was drawn to and held firmly in place by a substantial nut, fitted well to the thread on the rod. But the forked connection for horizontal engines has since been supplanted by the single end rod, and consequently the nut on the end of the piston-rod has been abandoned, by reason of the inconvenience of screwing it up to place, and because its use added a few inches length to the cross-head. This change of front was, at the time it was made, a great mistake, and was so pronounced by many engineers. At all events, there has never been a better fastening used since, although there are several other methods in use at this date.

The screwing of a piston-rod into a *cast iron* cross-head, with a jam nut at the back of the cross-head hub, is about the most unsatisfactory device in use, but some of the most extensive manufacturers have constructed their cross-heads in this way for years. They fought against fate, however, in this matter of design, and I notice with pleasure their adoption of an old, but better plan. They now use either the double or single round end thin steel key. It is true that the key slot weakens the rod, but no more than the coarse V-threads they formerly used. By this latter plan the piston rod can be disconnected from the cross-head in one-tenth part of the time required in so doing with the screw arrangement, and there is no damage to the rod in either connecting or disconnecting when the key is used, while by the screw method the piston-rod thread is injured, more or less, every time it is removed from the cross-head. Then, in using the screw and check-nut fastening, the builders make their beds so narrow at the slides (the idea being compactness of design) that I have positive evidence that there are now in this country nearly two hundred engines, the piston-rods of which must be removed from the cross-head, and the cross-head removed from the slides and bed plate, *before the cross-head pin brasses, and connecting rod strap can be taken out for examination or adjustment.*

The above operation requires not less than one hour on a fifty-horse power engine, and the same time to replace the parts named. These facts lead us to the conclusion that the best way of making the piston-rod fast to the cross-head is by the old taper end design, with a wrought-iron nut, drawing the rod home against the taper, and a substantial shoulder. The nut can be cylindrical in form, as we now have several ways of screwing round nuts to a solid bearing in close quarters. Then the only change it makes in the cross-head is a few inches additional length. When the nut is in position, it is firmly fastened by a clip attached to the cross-head proper, and this precaution insures it against any liability of getting loose.

Piston rods should in all cases be made of machinery steel, well hammered. The allowance for turning from the rough bar need not be more than $\frac{3}{32}$ds of an inch. Nothing is better adapted to the tensil and compressive strains of a piston-rod than the above-named metal. It is free to turn and finish, and polishes to a beautiful surface after a few weeks running. The common, and perhaps the best way of securing the piston to the piston-rod is the shrinking process. It is certainly the cheapest; but one piece of machine work connected with this part must be done with great care—this is the *boring* of the piston head. The hole must be absolutely true and of equal diameter throughout its whole length, in order to have a uniform and perfect grip on the rod when cold after shrinking.

Two years ago the writer repaired a twenty inch cylinder engine, after a breakage from a loose piston. A few moments' examination disclosed the fact, that the hole had been bored by improper attention to the tool, $\frac{1}{50}$th of an inch tapering. The piston was seven inches deep, but had a bearing on the rod of only 1⅛th inches; the riveting on the end of the rod being too slight to offer any resistance to the loose piston. It would have cost no more to have made this a perfect job in the first place, but it cost two hundred dollars to make it a perfect one after the break.

WM. H. HOFFMAN,
Passaic, N. J.

Engineering Explanations.

One of our readers sends us the following communication, making some inquiries in reference to Mr. Wm. Lee Church's article on "Engineering Popularized." We have referred the matter to Mr. Church, whose notes appear in brackets in their proper connection, also a further explanatory note at the close of the communication:

Lapeer, Mich., July 14, 1879.

Editor American Machinist:

I experienced great difficulty in following Mr. Church in his letters, because I did not understand the terms used and their meaning. If you will publish the above card with its definition you will doubtless confer a favor on nine-tenths of your readers. Mr. Church makes the mistake of supposing his readers are scientific, while, as a class, they are not.

A.B. Atmospheric Line, is traced when the atmosphere has free access to both sides of

piston of the indicator. [This line is drawn by the indicator pencil before the steam is admitted.]

B. C. Clearance Line represents the waste-room between the cut-off valve and piston-head when the latter is at end of its stroke. [This line is laid off a certain distance from the steam end of the card, which distance is to the length of the card as the total volume of clearance including parts is to the piston displacement. The volume of clearance is found by calculation, or direct measurement with water]

V. V. Vacuum Line, represents perfect vacuum, or absence of all pressure, and is drawn fourteen and one-half pounds below atmosphere line. [This line is laid down by scale after the card is taken from the instrument.]

D. E. Admission Line: represents the rise of pressure due to the admission of steam to the cylinder.

E. F. Steam Line: is braced while the steam is being admitted to the cylinder.

F. Point of cut-off: it is where the steam is cut off by valve. The practice is to locate the point of cut-off where the outline of the diagram changes its direction of curvature from convex to concave. [The apparent cut-off may also be found by extending the expansion curve up by the eye until it cuts the steam line.]

F. G. Expansion curve: it represents the fall of pressure due to the expansion of steam remaining in cylinder after cut-off.

G. Point of Exhaust: where the steam is released from cylinder. Like point of cut-off, it is located at the point of contrary flexure.

G. H. Exhaust Line: it is traced while the excess of pressure remaining at the point of exhaust is being released.

H. I. Back Pressure Line: it represents the pressure ahead of piston during the return strokes.

I. D. Compression curve: it shows the rise of pressure due to the compression of the steam shut in cylinder by closure of exhaust. [The above lines are obviously made by the instrument.]

Mean effective pressure is the difference between the mean or average impelling pressure and the mean back pressure.

Terminal pressure applies to exhaust or release pressure that would exist at the end of stroke, if the steam had not been released earlier.

Initial pressure is the pressure which acts on the piston at the beginning of stroke.

Respectfully,
E. R. CHASE,
Engineer.

It is probably desirable to begin back a little and give the definitions of the various lines of the diagram as your correspondent has done. I, however, offer no apology for the omission, as I stated in my opening article that it was not intended to go over the elements of the indicator diagram, as their can be no improvement in that respect on the many treatises in print. The object of these papers was rather to talk up some of the fresher points of engineering, without wasting much time in going over old ground. I have taken the liberty of interlining some further explanatory remarks of my own, for which I beg Mr. Chase's pardon.

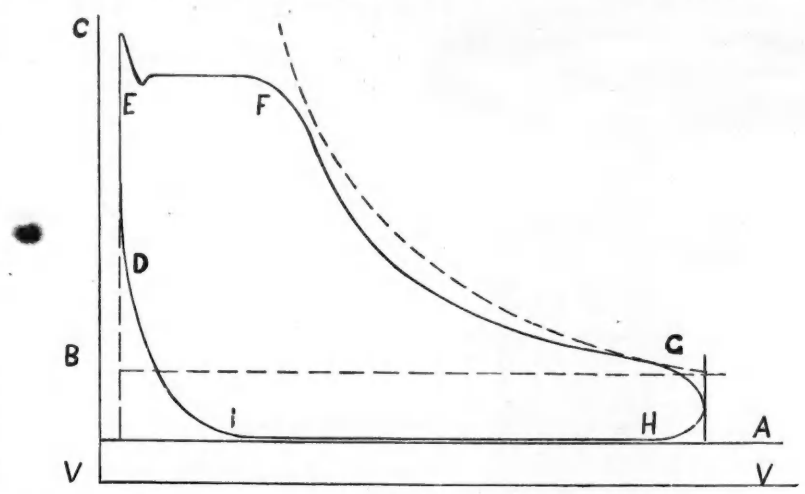
WM. LEE CHURCH.

Balanced Slide Valve.

We illustrate herewith a new Balanced Slide Valve, invented by Rufus G. Bishop, Chetopah, Kansas, but which we believe, has not yet been placed on the market as an article of manufacture.

The invention consists of a center chest cast on the cylinder, and of side chests secured thereto. At both ends of the center box are lateral chambers, opening by ports into the cylinder, for inducting and educting the steam, the lateral ports opening also side-wise into the side chests, in which two slide-valves, that are connected by transverse screw-bolts, are reciprocated.

The center chest communicates, by large exhaust openings, with the slide-valves and



cylinder, and is exhausted through the lid of the chests, the steam entering through a raised top or branched pipe to the side chests.

Referring to the engraving, A represents the center chest, which is preferably cast in one piece with the cylinder; and B, the side chests, which are firmly bolted thereto by means of transverse bolts, *a*, passing through the ends of the side chests.

The center and side chests are closed by a tightly fitted lid bolted over the same. The outer surfaces of the side walls of the center chest A are planed off to form the valve seats of the slide-valves D. The valve seats have the advantage of being readily reached for planing by removing the side chests.

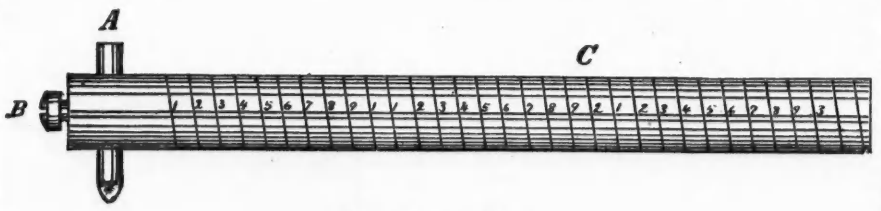
The side chests are connected with the engine by transverse chambers at both ends of the main chest, that open into the cylinder, and communicate, also, by side ports with the side chests. The side chests communicate through the end chambers and arched or scooped parts of the slide valves D, with the center chest A, which has large exhaust openings.

The slide-valves are laterally connected by screw-bolts and worked jointly by the eccentric rod E, connected to the eccentric. The valves, being hung together, are perfectly balanced, as their surfaces are alike.

The steam enters into the side chests either by a raised box or top, and side openings of lid, or by a pipe branching out to the side openings of the lid, so as to induct the steam simultaneously to both side chests. The steam is exhausted through a port in the center part of the lid.

The slide-valves are more or less tightly pressed on their seats by the connecting bolts, the inner and outer nuts of which at the ends admit the adjustment of the valves on the seats.

The eccentric rod is attached in suitable manner to the screw bolts, and, guided in a thimble or tube, passes around the rod through the end chamber. The rod needs no packing, as only exhaust steam is around the rod, the live steam being prevented from escaping by the guide thimble.



NEW BORING TOOL.

The stay rods of the valves work in the exhaust openings of the chests, and are not in the way, the arched parts of the valves being made long to correspond to the long exhaust openings.

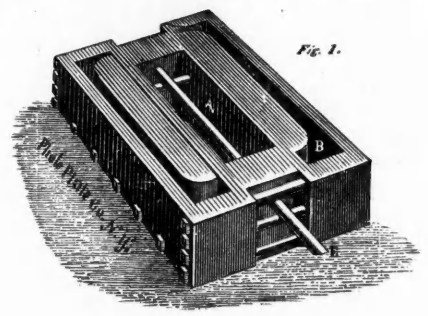
The entrance ports to the cylinder are short, the steam being conducted to the piston directly without crooked passages The wear of the valves is claimed to be even and the running of the same easy, as the valves are perfectly balanced, the steam being inducted at one end through one of the end chambers and ports, and exhausted freely through the port and chamber at the other end, and through the large exhaust openings of the center chest to the outside.

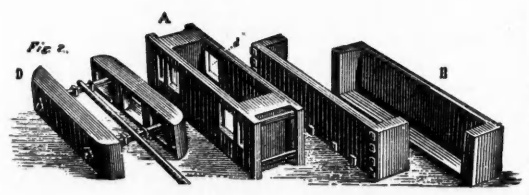
It is claimed that valves made upon the above principle will be simple and durable, not liable to wear out or leak, and adapted for use on any steam engine.

Pittsburg, July 17, '79.

Editor American Machinist:

DEAR SIR:—In your issue of July 5th I notice an illustration of a new boring tool, said to have been designed by W. S. Harris.





BALANCED SLIDE VALVE.

Unless Mr. Harris ante-dates me, he has only re-invented the tool described, which I designed and used seven years ago.

Yours Respectfully,
W. D. YOUNG,
Pittsburg, Pa.

Waltham, Mass., July 16th, 1879.

Mr. Editor:

In your issue of July 5th, you notice, as *new*, a boring tool, which is *old* in watch factories, and on which we have an important addition, which, if thought to be worthy of notice, you are at liberty to make public. The enclosed sketch shows the holder C; wire cutter A, held in place by set-screw B. This reduces cost of boring tools to the lowest point.

We make a fine line, longitudinally, which is intersected by a fine thread line, the first intersection being in center of tool A. The other intersections serve as measuring points, and show position of cutter, *i. e.* depth at which it is working. We have found the above to be a useful tool and hope others may.

Respectfully,
AM. WATCH TOOL CO.,
by A. WEBSTER.

The Engineer.

[*Continued from the 12th of July No.*]

BY STEPHEN ROPER.

Mr. Editor:

In my last article on this subject it was stated that, while nearly all of us agree that there should be a license law which would reach, or apply, to all classes of engineers, there were many difficulties to be be overcome in the impartial administration or execution of the same, which may be summed up as follows: In the first place, it would be almost impossible to place the office of examiner or inspector beyond the reach of political influence; second, examiners are rarely ever practical men, as they generally receive their appointments for political services rendered, or claimed to be; third, it is very difficult for a stranger, to judge a man's qualifications as an engineer with any degree of certainty, in comparison with those who are in daily intercourse with him, which goes to show that unless it is possible to determine to a certainty a man's ability, as an engineer, the license is no safeguard.

For this reason examinations ought to be conducted in the engine and boiler rooms, where the persons applying for certificates are employed. In that case there would be an opportunity to test the candidates practical knowledge of everything connected with the engines and boilers under his charge; and indeed, there can be no reason why persons whose duty it is to inquire into the capabilities of parties having charge of steam engines and boilers, should not do so on the premises, or on the vessels on which they are employed.

But, even if there was a legal enactment requiring every man having charge of a steam engine and boiler to undergo an examination and take out a license, it would afford very little protection to competent men, as the incompetent person would be just as likely to pass through as the competent man. Perhaps he would bring a strong letter of recommendation from his last employer, as a reward for being willing to degrade himself to a "man of all work," or he might bring one from an old friend of the examiner's, from a ward politician, or he might slip a "V" or an "X" into the "heel" of the examiner's fist at a moment when he was unconscious of the events that were transpiring around him. To be sure the examiner would be sworn to faithfully discharge the duties of his office, but so are judges and juries, U. S. Marshals, etc.; but such oaths furnish no general guarantee that the law will be impartially administered.

If the Legislature of the state of New York should enact a law forbidding unlicensed men to take charge of steam machinery, under a penalty of fine or imprisonment, there would not be one less *fraud* in the business than to-day, as there would be any amount of loop-holes discovered by which to evade the act. Besides, engineers in general do not wish to sanction or encourage such a law, as they know that under a rigid examination they would not stand the ghost of a chance, consequently they are not very anxious to cut a rod to whip themselves. Many members of the Legislatures of the States of the Union are manufacturers, owning steam engines and boilers and employing engineers, who would be in no hurry to disturb the relations which exist between themselves and their employees. It is even doubtful whether a law that would be of any value, or afford any protection in this case, could be carried through the Legislature of any of the States, simply because its advocates cannot afford to go into the bribery business. No doubt those in favor of the law, as well as those against it, would receive any amount of consolation, about one week before election, but when those in favor of it come to look for the realization of their hopes, they would find it a good ways back on the docket.

Another view is, that thousands of the men who have charge of steam engines and boilers have no theoretical, and but little practical, education; nevertheless, they have grown old in that kind of employment, and the

left. When the point c^1 has arrived at c, (any other point on the end of cross-head can be taken, the point c being changed to correspond), the edge of valve, g, Fig. 5, should have just come, line and line, with outside edge of port h, same figure. If the valve's edge does not occupy this position, but should have over-traveled, as shown by dotted lines j, the valve cuts off too early, which leads to a distorted action, closing the exhaust port too much. The remedy is to cut off that portion of valve which overlaps. This condition the writer has never found in practice. The writer does not mean to assert that the plain slide-valve cannot *be made* to cut off closer than ¾ of the stroke, without especially distorting the valve's action, but the amount is so small and necessitating the enlargement of the ports in width, and consequently the valve, with the attending evil of excessive valve surface exposed to pressure, that the writer believes that ¾ of the stroke should not be exceeded by the valve alone and unaided by special cut-off devices. If, as is often the case, the valve's outside edge, when cross-head is at ¾ of its stroke, should not have closed the port, but should leave it open, and the edge of valve be in line with —say the line i i, Fig. 5—the valve cuts off too late, and should have its lap on both ends increased by just the amount it lacks of just closing the port. Whatever is cut off or added to either end, should be cut off or added equally to the other end.

To get at the point of exhaust it will be necessary to make use of the lines mentioned in first part of this article. Move the crosshead by turning engine till it has traveled $\frac{9}{10}$ of its stroke (till c corresponds with e). The valve is now moving from right to left, and should occupy the position regarding the ports shown in Fig 6; that is, the edge of exhaust cavity Z should stand line and line with inside edge of steam port, as shown; that is, the line $a1$ on valve, which is on the left hand side of valve when valve is on valve slot, as shown in Fig. 3, should compare with line $b2$ on chest, which corresponds with inside edge of steam post. At this point the exhaust is just opening for the escape of steam; as shown by arrow in Fig. 6. Should the edge of valve, when cross-head is at $\frac{9}{10}$ of its stroke, occupy the position of line KK, the exhaust opens too soon, and should have the amount that it opens port at this point added to both edges of the exhaust cavity. On the chest this condition will be shown by the line $a1$ on valve standing to the *left* of line $b2$, and between lines $b2$ and $b1$. If, on the other hand, the edge of valve cavity Z should stand on a line with line LL, Fig. 6, the exhaust opens too late and should have the amount it lacks from coming line and line with inside edge of steam port cut out of both edges of cavity of valve. By the lines this condition will be shown by the line $a1$, on valve standing to the *right* of line $b2$ on chest and between $b2$ and $b3$, ss in Fig. 3 being steam ports, as represented by the lines, and tt the bridges and e the exhaust port.

However, the amount cut from exhaust cavity should never be enough to make width of cavity *exceed* the distance between the two inside edges of steam ports, or the distance X, Fig. 2. This would allow a passage from end to end of cylinder at the moment valve passed the center line of ports, and, although used by some engineers (?), it is bad practice, and is, at best, a mistake to correct a mistake. The writer assumes in above that the outside lap, as ascertained by this mode, never exceeds the width of steam port, that the exhaust port is twice, or nearly so, the width of steam port, as, under their conditions, if the bridges are nearly equal in width to the steam port (as they generally are) and the throw of eccentric is sufficient to open steam port; fairly open, the exhaust port, at its minimum opening is half open to the escape of the exhaust. Hence, as this opening is equal to the steam port in area, the exhaust can never be cramped. The compression will not be found to be excessive, but sufficient to take up all lost motion. Very little lead should be given. The closing of the exhaust can be found by the lines. If the exhaust cavity is "line and line" with inside edges of steam ports, compression and release are simultaneous. Where an engine is hard pressed for power occasionally, it will be better to proportion value as above and speed up engine instead of increasing power by carrying steam to a greater portion of the stroke, with the liability of a cramped exhaust, the reduction of outside lap necessary to carry steam farther giving a reduced exhaust lead and choked exhaust. Where outside lap is added to a valve the throw of eccentric must be increased the same amount, unless travel of valve can be augmented by other means. In most cases, the cheapest plan, after ascertaining the new proportion of valve, will be to make a new valve instead of patching up an old one, remembering to ascertain first if the size of steam chest will admit of an increase of valve's travel.

V. HOOK.

Self Feeding Ratchet Drills.

Of the number of self feeding ratchet drills that are manufactured at the present time, few have come up to the requirements of such a tool. It is claimed by the inventor of the ratchet represented in our illustrations, that this has been a successful attempt to construct a ratchet that combines simplicity, efficiency, and durability,

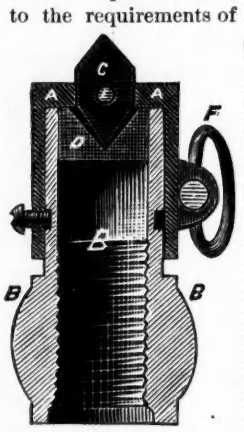


FIG. 1.

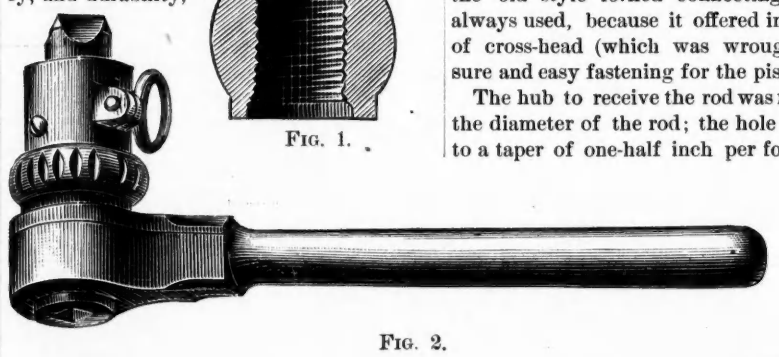


FIG. 2.

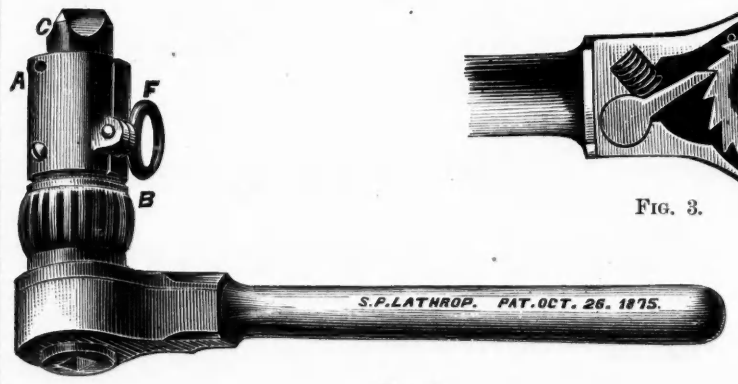


FIG. 4.

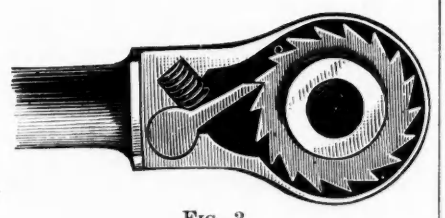


FIG. 3.

with a perfectly reliable and powerful self-feed, capable of being instantly adjusted to any required cut, and equally adapted to the lightest, as well as to the heaviest work. This, the inventor claims, has been obtained by a novel combination, at once simple, and certain in its operation, and by the use of which we are enabled to perform a given amount of work, in a great deal less time than it can be done by many other ratchet drills now in the market.

The general construction of this ratchet is of such a nature as to insure great durability; and is capable of doing very heavy with the same certainty of operation as on light work. Referring to Fig. 1, we will describe the self-feeding device, and its operation.

The inside or feed sleeve B, also shown in Fig. 4 at B, which screws upon the drill spindle, is fitted with a friction or outer sleeve A, in the head of which is secured a steel chisel-shaped pin C, the lower end of which is pointed and rests upon a hardened steel-bearing D, fixed in the head of the inner sleeve B. This sleeve, with its bearing D, revolves upon the point of the pin C, and within the friction sleeve A. Having thus described its construction, we will now describe the operation of the self-feeding device. The head of the pin C being chisel-shaped, prevents the pin and the outer sleeve A from revolving. If the thumb, or friction screw F, is unscrewed, it will permit the inner sleeve B to rotate freely upon the bearing of pin C, and within the friction sleeve A. As the screw F is tightened, the friction upon the inner sleeve B is increased, causing it to remain stationary, and consequently causing the screw on the drill spindle to feed the drill, until the friction on the drill becomes greater than the friction on the sleeve B. This then commences to rotate again within the outer sleeve A, and continues until the chip, which the drill has commenced to cut, is finished, when the same operation is repeated, thus giving a continuous feed, capable of being instantly adjusted to feed fast or slow, as desired, by tightening or loosening the friction screw F, thereby causing a greater or less friction upon the inside, or feed sleeve B.

Fig. 2 shows a pattern designed for short work, where the size shown in Fig. 4 could not be used. Fig. 3 shows the construction of the paul, spring, ratchet, and their application. Four sizes of these ratchets are furnished for general work, and two sizes for boiler makers. They are manufactured by S. Park Lathrop, 200 Market St., Newark, N. J.

Engine Proportion and Construction.

THE SECURING OF PISTON-ROD TO CROSS-HEAD.

Editor American Machinist:—

In the early days of the horizontal engine, the old style forked connecting rod was always used, because it offered in the form of cross-head (which was wrought iron) a sure and easy fastening for the piston-rod.

The hub to receive the rod was made twice the diameter of the rod; the hole was bored to a taper of one-half inch per foot, and the length of hub was three times the diameter of rod The rod was turned at the end to an accurate fit for the taper in cross-head, with thread on extreme end. It was drawn to and held firmly in place by a substantial nut, fitted well to the thread on the rod. But the forked connection for horizontal engines has since been supplanted by the single end rod, and consequently the nut on the end of the piston-rod has been abandoned, by reason of the inconvenience of screwing it up to place, and because its use added a few inches length to the cross-head. This change of front was, at the time it was made, a great mistake, and was so pronounced by many engineers. At all events, there has never been a better fastening used since, although there are several other methods in use at this date.

The screwing of a piston-rod into a *cast iron* cross-head, with a jam nut at the back of the cross-head hub, is about the most unsatisfactory device in use, but some of the most extensive manufacturers have constructed their cross-heads in this way for years. They fought against fate, however, in this matter of design, and I notice with pleasure their adoption of an old, but better plan. They now use either the double or single round end thin steel key. It is true that the key slot weakens the rod, but no more than the coarse V-threads they formerly used. By this latter plan the piston rod can be disconnected from the cross-head in one-tenth part of the time required in so doing with the screw arrangement, and there is no damage to the rod in either connecting or disconnecting when the key is used, while by the screw method the piston-rod thread is injured, more or less, every time it is removed from the cross-head. Then, in using the screw and check-nut fastening, the builders make their beds so narrow at the slides (the idea being compactness of design) that I have positive evidence that there are now in this country nearly two hundred engines, the piston-rods of which must be removed from the cross-head, and the cross-head removed from the slides and bed plate, *before the cross-head pin brasses, and connecting rod strap can be taken out for examination or adjustment.*

The above operation requires not less than one hour on a fifty-horse power engine, and the same time to replace the parts named. These facts lead us to the conclusion that the best way of making the piston-rod fast to the cross-head is by the old taper end design, with a wrought-iron nut, drawing the rod home against the taper, and a substantial shoulder. The nut can be cylindrical in form, as we now have several ways of screwing round nuts to a solid bearing in close quarters. Then the only change it makes in the cross-head is a few inches additional length. When the nut is in position, it is firmly fastened by a clip attached to the cross-head proper, and this precaution insures it against any liability of getting loose.

Piston rods should in all cases be made of machinery steel, well hammered. The allowance for turning from the rough bar need not be more than $\frac{5}{32}$ds of an inch. Nothing is better adapted to the tensil and compressive strains of a piston-rod than the above-named metal. It is free to turn and finish, and polishes to a beautiful surface after a few weeks running. The common, and perhaps the best way of securing the piston to the piston-rod is the shrinking process. It is certainly the cheapest; but one piece of machine work connected with this part must be done with great care—this is the *boring* of the piston head. The hole must be absolutely true and of equal diameter throughout its whole length, in order to have a uniform and perfect grip on the rod when cold after shrinking.

Two years ago the writer repaired a twenty inch cylinder engine, after a breakage from a loose piston. A few moments' examination disclosed the fact, that the hole had been bored by improper attention to the tool, $\frac{1}{50}$th of an inch tapering. The piston was seven inches deep, but had a bearing on the rod of only 1$\frac{1}{2}$th inches; the riveting on the end of the rod being too slight to offer any resistance to the loose piston. It would have cost no more to have made this a perfect job in the first place, but it cost two hundred dollars to make it a perfect one after the break.

WM. H. HOFFMAN,
Passaic, N. J.

Engineering Explanations.

One of our readers sends us the following communication, making some inquiries in reference to Mr. Wm. Lee Church's article on "Engineering Popularized." We have referred the matter to Mr. Church, whose notes appear in brackets in their proper connection, also a further explanatory note at the close of the communication:

Lapeer, Mich., July 14, 1879.

Editor American Machinist:

I experienced great difficulty in following Mr. Church in his letters, because I did not understand the terms used and their meaning. If you will publish the above card with its definition you will doubtless confer a favor on nine-tenths of your readers. Mr. Church makes the mistake of supposing his readers are scientific, while, as a class, they are not.

A.B. Atmospheric Line, is traced when the atmosphere has free access to both sides of

piston of the indicator. [This line is drawn by the indicator pencil before the steam is admitted.]

B. C. Clearance Line represents the waste-room between the cut-off valve and piston-head when the latter is at end of its stroke. [This line is laid off a certain distance from the steam end of the card, which distance is to the length of the card as the total volume of clearance including parts is to the piston displacement. The volume of clearance is found by calculation, or direct measurement with water]

V. V. Vacuum Line, represents perfect vacuum, or absence of all pressure, and is drawn fourteen and one-half pounds below atmosphere line. [This line is laid down by scale after the card is taken from the instrument.]

D. E. Admission Line: represents the rise of pressure due to the admission of steam to the cylinder.

E. F. Steam Line: is braced while the steam is being admitted to the cylinder.

F. Point of cut-off: it is where the steam is cut off by valve. The practice is to locate the point of cut-off where the outline of the diagram changes its direction of curvature from convex to concave. [The apparent cut-off may also be found by extending the expansion curve up by the eye until it cuts the steam line.]

F. G. Expansion curve: it represents the fall of pressure due to the expansion of steam remaining in cylinder after cut-off.

G. Point of Exhaust: where the steam is released from cylinder. Like point of cut-off, it is located at the point of contrary flexure.

G. H. Exhaust Line: it is traced while the excess of pressure remaining at the point of exhaust is being released.

H. I. Back Pressure Line: it represents the pressure ahead of piston during the return strokes.

I. D. Compression curve: it shows the rise of pressure due to the compression of the steam shut in cylinder by closure of exhaust. [The above lines are obviously made by the instrument.]

Mean effective pressure is the difference between the mean or average impelling pressure and the mean back pressure.

Terminal pressure applies to exhaust or release pressure that would exist at the end of stroke, if the steam had not been released earlier.

Initial pressure is the pressure which acts on the piston at the beginning of stroke.

Respectfully,
E. R. Chase,
Engineer.

It is probably desirable to begin back a little and give the definitions of the various lines of the diagram as your correspondent has done. I, however, offer no apology for the omission, as I stated in my opening article that it was not intended to go over the elements of the indicator diagram, as their can be no improvement in that respect on the many treatises in print. The object of these papers was rather to talk up some of the fresher points of engineering, without wasting much time in going over old ground. I have taken the liberty of interlining some further explanatory remarks of my own, for which I beg Mr. Chase's pardon.

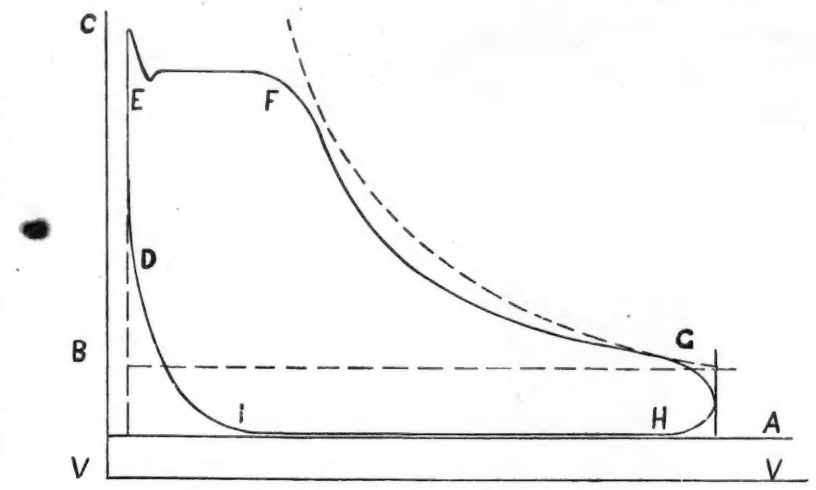
Wm. Lee Church.

Balanced Slide Valve.

We illustrate herewith a new Balanced Slide Valve, invented by Rufus G. Bishop, Chetopah, Kansas, but which we believe, has not yet been placed on the market as an article of manufacture.

The invention consists of a center chest cast on the cylinder, and of side chests secured thereto. At both ends of the center box are lateral chambers, opening by ports into the cylinder, for inducting and educting the steam, the lateral ports opening also side-wise into the side chests, in which two slide-valves, that are connected by transverse screw-bolts, are reciprocated.

The center chest communicates, by large exhaust openings, with the slide-valves and



cylinder, and is exhausted through the lid of the chests, the steam entering through a raised top or branched pipe to the side chests.

Referring to the engraving, A represents the center chest, which is preferably cast in one piece with the cylinder; and B, the side chests, which are firmly bolted thereto by means of transverse bolts, *a*, passing through the ends of the side chests.

The center and side chests are closed by a tightly fitted lid bolted over the same. The outer surfaces of the side walls of the center chest A are planed off to form the valve seats of the slide-valves D. The valve seats have the advantage of being readily reached for planing by removing the side chests.

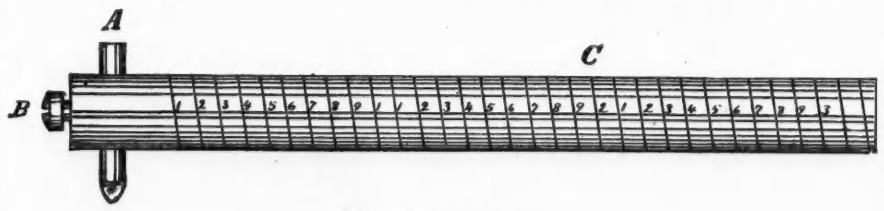
The side chests are connected with the engine by transverse chambers at both ends of the main chest, that open into the cylinder, and communicate, also, by side ports with the side chests. The side chests communicate through the end chambers and arched or scooped parts of the slide valves D, with the center chest A, which has large exhaust openings.

The slide-valves are laterally connected by screw-bolts and worked jointly by the eccentric rod E, connected to the eccentric. The valves, being hung together, are perfectly balanced, as their surfaces are alike.

The steam enters into the side chests either by a raised box or top, and side openings of lid, or by a pipe branching out to the side openings of the lid, so as to induct the steam simultaneously to both side chests. The steam is exhausted through a port in the center part of the lid.

The slide-valves are more or less tightly pressed on their seats by the connecting bolts, the inner and outer nuts of which at the ends admit the adjustment of the valves on the seats.

The eccentric rod is attached in suitable manner to the screw bolts, and, guided in a thimble or tube, passes around the rod through the end chamber. The rod needs no packing, as only exhaust steam is around the rod, the live steam being prevented from escaping by the guide thimble.



New Boring Tool.

The stay rods of the valves work in the exhaust openings of the chests, and are not in the way, the arched parts of the valves being made long to correspond to the long exhaust openings.

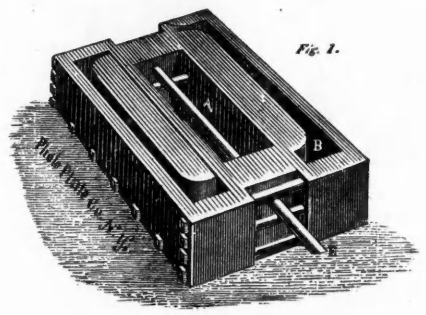
The entrance ports to the cylinder are short, the steam being conducted to the piston directly without crooked passages The wear of the valves is claimed to be even and the running of the same easy, as the valves are perfectly balanced, the steam being inducted at one end through one of the end chambers and ports, and exhausted freely through the port and chamber at the other end, and through the large exhaust openings of the center chest to the outside.

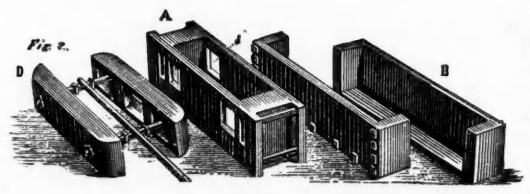
It is claimed that valves made upon the above principle will be simple and durable, not liable to wear out or leak, and adapted for use on any steam engine.

Pittsburg, July 17, '79.

Editor American Machinist:

Dear Sir:—In your issue of July 5th I notice an illustration of a new boring tool, said to have been designed by W. S. Harris.





Balanced Slide Valve.

Unless Mr. Harris ante-dates me, he has only re-invented the tool described, which I designed and used seven years ago.

Yours Respectfully,
W. D. Young,
Pittsburg, Pa.

Waltham, Mass., July 16th, 1879.

Mr. Editor:

In your issue of July 5th, you notice, as *new*, a boring tool, which is *old* in watch factories, and on which we have an important addition, which, if thought to be worthy of notice, you are at liberty to make public. The enclosed sketch shows the holder C; wire cutter A, held in place by set-screw B. This reduces cost of boring tools to the lowest point.

We make a fine line, longitudinally, which is intersected by a fine thread line, the first intersection being in center of tool A. The other intersections serve as measuring points, and show position of cutter, *i. e.* depth at which it is working. We have found the above to be a useful tool and hope others may. Respectfully,

Am. Watch Tool Co.,
by A. Webster.

The Engineer.

[*Continued from the 12th of July No.*]

BY STEPHEN ROPER.

Mr. Editor:

In my last article on this subject it was stated that, while nearly all of us agree that there should be a license law which would reach, or apply, to all classes of engineers, there were many difficulties to be be overcome in the impartial administration or execution of the same, which may be summed up as follows: In the first place, it would be almost impossible to place the office of examiner or inspector beyond the reach of political influence; second, examiners are rarely ever practical men, as they generally receive their appointments for political services rendered, or claimed to be; third, it is very difficult for a stranger, to judge a man's qualifications as an engineer with any degree of certainty, in comparison with those who are in daily intercourse with him, which goes to show that unless it is possible to determine to a certainty a man's ability, as an engineer, the license is no safeguard.

For this reason examinations ought to be conducted in the engine and boiler rooms, where the persons applying for certificates are employed. In that case there would be an opportunity to test the candidates practical knowledge of everything connected with the engines and boilers under his charge; and indeed, there can be no reason why persons whose duty it is to inquire into the capabilities of parties having charge of steam engines and boilers, should not do so on the premises, or on the vessels on which they are employed.

But, even if there was a legal enactment requiring every man having charge of a steam engine and boiler to undergo an examination and take out a license, it would afford very little protection to competent men, as the incompetent person would be just as likely to pass through as the competent man. Perhaps he would bring a strong letter of recommendation from his last employer, as a reward for being willing to degrade himself to a "man of all work," or he might bring one from an old friend of the examiner's, from a ward politician, or he might slip a "V" or an "X" into the "heel" of the examiner's fist at a moment when he was unconscious of the events that were transpiring around him. To be sure the examiner would be sworn to faithfully discharge the duties of his office, but so are judges and juries, U. S. Marshals, etc.; but such oaths furnish no general guarantee that the law will be impartially administered.

If the Legislature of the state of New York should enact a law forbidding unlicensed men to take charge of steam machinery, under a penalty of fine or imprisonment, there would not be one less *fraud* in the business than to-day, as there would be any amount of loop-holes discovered by which to evade the act. Besides, engineers in general do not wish to sanction or encourage such a law, as they know that under a rigid examination they would not stand the ghost of a chance, consequently they are not very anxious to cut a rod to whip themselves. Many members of the Legislatures of the States of the Union are manufacturers, owning steam engines and boilers and employing engineers, who would be in no hurry to disturb the relations which exist between themselves and their employees. It is even doubtful whether a law that would be of any value, or afford any protection in this case, could be carried through the Legislature of any of the States, simply because its advocates cannot afford to go into the bribery business. No doubt those in favor of the law, as well as those against it, would receive any amount of consolation, about one week before election, but when those in favor of it come to look for the realization of their hopes, they would find it a good ways back on the docket.

Another view is, that thousands of the men who have charge of steam engines and boilers have no theoretical, and but little practical, education; nevertheless, they have grown old in that kind of employment, and the

question now is, would it be right to deprive them of the means of making a living, in the only business for which they are fit? I think not; the only security for engineers in the future, appears to lie in a law which would require every person to possess an elementary knowledge of steam, and steam-machinery, before being permitted to take charge of an engine or boiler; as being once recognized as engineers, they frequently become too conceited to take instructions from others, or even to ask a question, although the answer might put them in possession of a fact of immense value to them. There is no reason why one class of men should be required to serve a regular apprenticeship, and even to devote years to the study of their profession, while another class is allowed to discharge all the duties of a calling, equally as important, with scarcely any preparation.

Examinations into the elementary knowledge of candidates, presenting themselves for admission into the engineering profession, should be conducted by a board of five, but in no case less than three, theoretical and practical engineers; a majority of whom should be men who have handled the starting bar, the shovel and the oil-can. They should be men of long experience and good common sense.

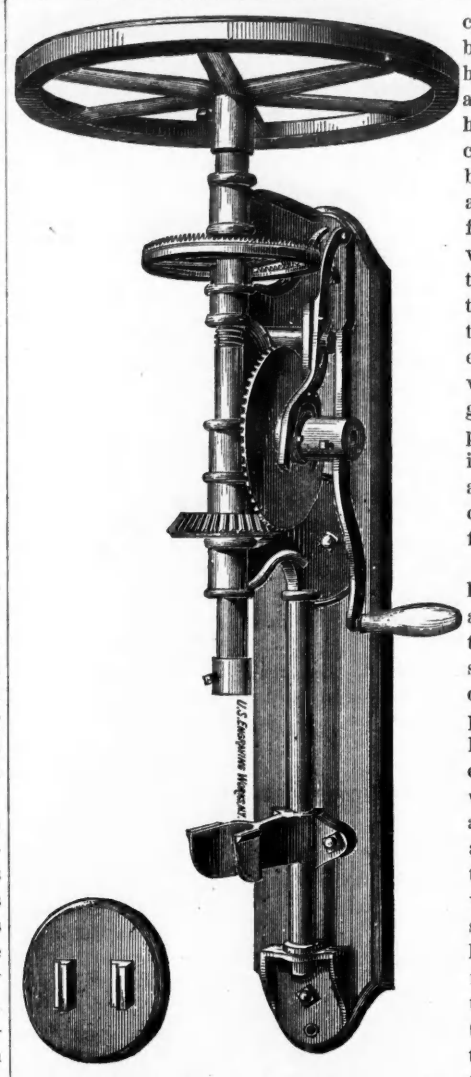
The question is often asked, Should an engineer be a machinist? The proper answer would be—not necessarily so; there is no reason why a man should learn two trades to follow one. Besides, experience has shown that, though machinists are, in some instances, the best judges of things that may transpire in relation to steam machinery, they are, nevertheless, frequently less careful, less reliable, and less ingenious, than those who never learned a regular trade. Moreover, neither Savery, Smeaton, Watt, Stevenson, Fitch, Fulton, or either of the Stevenses, Baldwin, nor Oliver Evans were machinists. An engineer should be possessed of natural talent, should be ingenious, and able to discover any defect that may occur in the machinery under his charge, be able to take up the lost motion, or to take apart, or put together the different parts of an engine.

Epitaph on an Engineer.

Here lies, in a horizontal position,
The remains of
George Washington Brown,
Steam Engineer,
Whose ability and skill were an honor
To the Craft.
His fire was even; water line at the middle cock; steam—just right.
Every action was marked by the pressure-gauge,
And limited by the safety-valve,
And so accurately was his machinery regulated, by the governor,
He never met with an accident,
Until most mysteriously,—'twas an unlucky day—
Boiler, engine, and building, with mortals ten,
All went up higher than a kite!
Poor Brown with nine others departed this life by steam,
Aged 46. Cincinnati, O., April 14th, 1871.
The Coroner held the deceased "a blameless man;"
He was always true;
'Twas the iron that was false;
Providential—so it was to be
Peace to his dust.

Blacksmith's Drill.

We illustrate herewith a new drill press intended for the use of blacksmiths, or wherever a cheap drill is required. Referring to the accompanying cut, the reader will observe that the different parts are constructed in a plain and substantial manner. The cut represents the No. 1 size, and has a self-feed attachment which can be adjusted to feed fast or slow. The handle is also adjustable to increase or diminish the power, which is a decided advantage in running fast. These drills have a heavy balance-wheel, which makes them run very easily and steadily. The table is so constructed that it can be removed as shown in the cut, so that the work to be drilled may be placed upon the bracket. There are five sizes of this drill, and each size is furnished with or without self-feeding attachments. The



hand-feeding device is of an improved pattern, and stands vertically, which is claimed to be more convenient for the operator. It also has a quick-return motion, upon which a patent is now pending. Furnished by Pierson & Co., No. 24 Broadway, N. Y.

A Wonderful British Invention.

Chordal sends us the following ridiculous thing taken from *The Mechanics' Magazine*, published in London. This is not a "blarsted Yankee contrivance." We copy cut and description. Any of our steam engine builders who desire to adopt this "very ingenious and useful" device can probably do so without being prosecuted for infringement.

"A very ingenious and useful invention has just been patented by N. Symons of Cambridge St., N. W., which consists in serrating or corrugating the upper and lower surfaces of pistons, commonly used in steam engines for the purpose of increasing the superficial area without increasing the diameter of the cylinder. The above engraving illustrates a cylinder of the ordinary construction, having the piston formed according to the above invention. The arrows indicate the action of the steam against the serrations. The cylinder cover and end are correspondingly shaped to enable the piston to complete the full stroke. According to the patent, every form of corrugations, indentations or grooves is protected. The invention is equally applicable to valves and cylinders of other than steam engines."

Steam Engineering.

BY CHAS. A. HAGUE.

Part II.

The average economic results of the best modern practice, are probably not far from 20 per cent. of total "heat value" of fuel; the average of ordinary performance, however, is far short of the above, and some specimens of the engineer's art in daily operation are doubtless so far in the rear, that they are very expensive property to own.

However well designed and constructed a steam engine may be, the full advantage of its merits cannot be realized unless the boiler is of a character and capacity to correspond. There are some boilers made in conformity to principles that render them capable of generating dry saturated steam, and in some cases superheated steam, but even with such boilers there is a very considerable waste of heat by radiation, absorption, &c.; there is also a comparatively large percentage of the heat of combustion, it will be observed, escapes up the chimney, for the reason that boilers giving off dry or superheated steam are so constructed, that some of the parts forming heating surface, come in contact with steam, and, of course, the heat from the furnace must be considerably higher than that of contained steam, and continue so all the way to uptake, where the remaining heat enters the chimney and is lost; and so it would seem that with the present methods of generating steam, even in best practice, a large proportion of heat produced is not utilized; in other words, before the water is evaporated and steam is ready to enter the pipe for conveyance to engine, the heat value of the fire is practically very materially reduced.

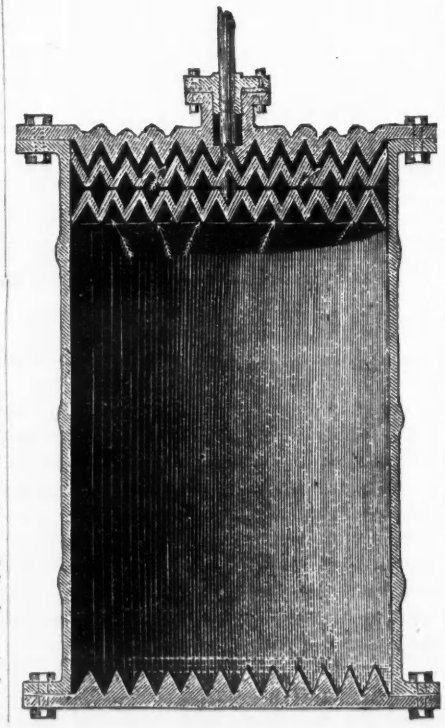
There is also a class of boilers, and doubtless the largest class in daily use, that are so arranged and operated that it is impossible to obtain dry steam from them; the heating surface is badly distributed, and, as a consequence, very little steam is generated at some points, while at others, the water absorbs heat so rapidly that the resulting steam in endeavoring to escape to the surface of the water, finds such crooked or narrow passages, that in forcing its way through them, a portion of the water is carried along, and the result is, the steam never gets rid of the water with which it (steam) becomes oversaturated; this result is assisted by loss of heat, with which the steam unavoidably meets; to add to the general short-comings, there is, generally, in such boilers, no opportunity for heat in the flues to come in contact with surface situated conveniently for the absorption of such heat by the over-saturated steam.

A steam boiler, to produce economical results, should be constructed and set so as to permit a free combustion of the fuel, and give sufficient volume of space for the hot gases to combine, in a manner calculated to effect the utmost production of heat due to fuel consumed.

Combustion of fuel is the *chemical combination* of the substance of the fuel with oxygen of the air, and now, before progressing any further with our subject, it will be desirable to present a few facts in Natural Philosophy.

A mechanical mixture: Is a *composition* in which the ingredients retain their natural properties; steam is a mechanical mixture of heat and water; atmospheric air is an invisible gas, produced by the mechanical mixture of two other gases, viz., oxygen and nitrogen.

A chemical combination: Is *an action*, during which certain elements and substances are absorbed and destroyed, in the production of some other element or substance. Heat is a product of the chemical combination of the element oxygen with a combustible substance, and to produce the maximum volume of heat from a given weight of fuel, it is necessary that a proper quantity of oxygen, and under correct conditions, be admitted to the furnace and combustion chamber.



The maximum rate of heat having been provided for, the surface of boiler exposed for its operation should be of sufficient extent to allow the necessary time for transmission of heat to contained water; when the heating surface is insufficient, the heat is certain to be carried through the flues or tubes and into uptake, before it (heat) can be absorbed to an economical extent.

There must be, also, ample room for the escape of steam to the surface of water, and after it has passed above the water, it would seem as though it was necessary to bring it (steam) again in contact with some heating surface, to thoroughly complete the evaporation, and even superheat the steam slightly, before it is finally allowed to pass to the engine.

Cases have been known in which the steam was apparently superheated to a considerable degree at the point where it entered the pipe leading to engine, but, on reaching the steam chest, had relapsed to temperature due to the pressure, although the pipe was protected from radiation in a manner that would forbid the supposition that heat enough had escaped to make the difference; the facts of the case were most probably, that the extent of heating surface in the boiler was excessive in proportion to quantity of water, and also very effectively situated, so that the steam, having an exceedingly favorable opportunity for escape to and above the surface of water, was generated and passed into the pipe so rapidly, that the evaporation was incomplete, although heat in excess of that due to the pressure was carried by the steam, and during the passage through steam pipe to the engine, sufficient time elapsed to allow the apparent surplus heat to be absorbed by the excess of moisture. With the ordinary horizontal tubular boiler, the production of dry steam is a very difficult task, unless some considerable heat is wasted; for the reason that it would be necessary to operate the boiler as near its capacity as possible, without causing it to prime, and to do this, comparatively "hard firing" would be unavoidable.

If the steam is not a trifle superheated when leaving boiler, it is hardly possible for it to be dry at the engine.

Engine cylinders without steam jackets, when working steam expansively, must necessarily indicate some symptoms of moisture, even when dry or superheated steam is used, because there is no opportunity for additional heat to enter the cylinder after cut-off valve has closed, and the loss of heat by the iron resulting from the peculiar effects of expansion of the steam must be made good from somewhere, and that source is eventually the condensation of a portion of initial steam at the next stroke of piston.

We may calculate, theoretically, the gross dynamic energy that should be developed from a certain weight of fuel, but the actual operation of the best-known practice must necessarily fall far short of the estimation, unless the boiler and furnaces can be so constructed that there will be absolutely no escape of heat, and the boiler room and all the appliances thereof, under such conditions, would indicate a temperature corresponding to that due to the weather, there must not, of course, be any heat escaping from the chimney; if we could thus burn fuel and produce steam without the slightest loss of heat whatever, it only remains to convert it into dynamic energy, until the temperature of the steam is reduced to that of the coolest feed-water used during the operation, assuming feed-water to be at a temperature of 60° Far. the steam must be expanded down to that degree, and it (steam) would then indicate a pressure of considerably less than one pound per inch above an absolute vacuum, or about 14.5 pounds per inch below the zero on the ordinary steam pressure gauge.

In order to comprehend the nature of a vacuum, it will be necessary to become thoroughly acquainted with a few facts concerning the air we breathe, and establish such

facts so firmly in the mind that they may be referred to as readily as to the letters and figures that form the basis of every-day information. In the first place, the fact must be clearly understood that the air in which we move is simply an invisible gas; the height or depth of this gas or air, reckoned from sea level, has been variously estimated, but it will serve our present purpose to assume it to be 50 miles in a vertical direction from the surface of the sea to upper surface of this strata of air.

Now the pressure of water is just its weight bearing upon the surface which supports it: this pressure is in proportion to the depth or height of the water above the supporting surface; water being a fluid, presses in every direction, but the vertical downward pressure is the greatest.

The weight or pressure of the air is of the same nature as that of water, differing from it only in intensity of force. A column of water 2 or 3 feet high exerts a pressure or weight of 1 pound per sq. inch; a column of air the full height of the atmosphere (50 miles), exerts a pressure or weight, on the earth's surface, varying from about 14 pounds per sq. inch to over 15 pounds, but the average is assumed to be 14.7 pounds per inch. If we take a hollow air-tight globe, and expel the air from it, the globe will be subjected to a crushing strain of 14.7 pounds per sq. inch of exterior surface, and the interior space will be in a condition of "vacuum;" an absolute vacuum would be produced if all the air could be forced out of the hollow globe.

The pressure gauge, by which the force of steam is indicated, exhibits only the pressure in excess of that due to the air; the completeness with which the air or other gas or vapor is removed from the interior of a vessel or chamber, or, in other words, the quality of the vacuum is measured by a "vacuum gauge;" the "zero" of the steam gauge and "zero" of the vacuum gauge exactly coincide, the steam gauge indicating pressure above the air or atmospheric line, while the vacuum gauge exhibits the pressure below that line; when the steam gauge attached to a boiler indicates a pressure of 100 pounds per inch, the pressure within boiler is actually about 114.7 pounds per inch, but 14.7 pounds of the pressure is balanced by the air outside of boiler, and the straining pressure is only 100 pounds. In calculating expansion of steam, the pressure required to balance that of the air must be added to the indication of the steam gauge, the same being the total pressure of steam above an absolute vacuum.

Chicago, July 7th, 1879.

Black River Falls and Suspension Bridge, Watertown, N Y.

Watertown—Its Manufactures and Water Power.

Mr. Editor:

It appears singular, but, nevertheless, a fact, that correspondents, generally, have the knack of finding out pleasant and picturesque places from which to write "a few lines." I certainly thought my "lines" had fallen in a pleasant place when I dropped into this pretty city of Watertown, in Northern New York. Peace and plenty is indicated on all sides, and the genial people one meets, extend, at once, the right hand of fellowship to new comers. If you think it worthy a place in your columns I will give you and your many readers a brief idea of the importance of the city, mechanically considered, as well as its crowning glory, the wonderful water-power it possesses.

Watertown is located 12 miles from Sacketts Harbor on lake Ontario, and connected with the N. Y. Central R. R. by the Utica and Black River R. R., which has its terminus at Utica. Its population is about 12,000. The educational and spiritual welfare of the people have been carefully cared for, as the many edifices devoted to each attest. There are no less than four National Banks and one State Bank, so you see the banking privileges and advantages are not overlooked.

The leading manufacturers are as follows:

Bagley & Sewall, who employ some 65 men. Their works and property cover between 2½ and 3 acres of land. They have the exclusive manufacture of the celebrated Prentiss Swivel-bottom and adjustable Jaw Vise, for the Hall Manufacturing Co., of New York City, which vise has grown into well-deserved favor throughout this country. They also manufacture about three tons of sewing machine castings daily; and also build Green's Rotary Force Pump, for which there is a large and increasing demand This firm, under the present style, has been in business for 26 years. The senior partner, Mr. Geo. A. Bagley, represented this (the 20th Congressional) District in Congress for the two terms, from 1874 to 1876, and 1876 to 1878. Their business is growing largely, have plenty of orders ahead, and are running on full time.

The Watertown Steam Engine Co. employ 100 hands, are full of orders, and are running on 12 hours' time. The steam engines and saw mills, and their agricultural engines, of which they make a specialty, have won an excellent reputation wherever used. Their works and land occupy over 2 acres. The officers are: Chas. A. Sherman, President; J. C. Knowlton, Vice-President; S.F. Baggs, Secretary and Treasurer; N. P. Wood, Superintendent.

The Eames Vacuum Brake Co are kept very busy, and employ 30 hands. This company was organized February, 1876, but did not get fairly started till February, 1878, since which time they have equipped, with their brake and attachments, some 350 engines, and 1,100 cars. The officers are: F. W. Eames, President; R. E. Ricker, Vice-President; C. D. Bingham, Secretary and Treasurer.

Davis Sewing Machine Co. employ in their works about 300 hands, are running on full time, and have plenty of orders ahead. It is also an incorporated Co. and the officers are: Willard Ives, President; Geo. A. Bagley, Vice-President; L. A. Johnson, Treasurer.

Hitchcock Lamp Co. are manufacturing a mechanical lamp, non-explosive, to be used without a chimney, emitting neither odor nor smoke. It will burn 14 hours with once winding, at a cost of one cent per hour, with fifteen candle-power. The officers are: R. P. Flower, President; F. T. Story, Vice-President; T. C. Chittenden, Treasurer; H. H. Sessions, Secretary; Robert Hitchcock, Superintendent.

The manufacture of paper is an extensive interest, and there are many large concerns, among whom are the Remington Paper Co., whose works and land occupy about two acres. They employ about fifty hands, and have a capacity of eight tons per day, and are running full time. The officers are: A. D. Remington, President; George P. Folts, Vice-President; Fred Emerson, Secretary; H. W. Boyer, Treasurer.

Knowlton Bros. employ about eighty five hands, and are kept very busy, running on full time and full of orders.

The Watertown Paper Co. employ about twenty-five hands, and are full of orders. The officers are: Hiram Remington, President; C. R. Remington, Secretary and Treasurer.

Taggart & Davis, who manufacture Manilla bags, as well as news paper, employ about forty-three hands, are running full time and have plenty of orders.

The press is well and ably represented by the Watertown *Times*, daily, and the *Reformer*, weekly. Published by Brockway & Sons.

Watertown *Morning Dispatch*, daily, Morning, and *Reunion*, Weekly. Published by the Watertown Printing Co., Limited.

Watertown *Post*, weekly. Published by L. Ingalls.

The manufactories and paper mills are all run by the great water power of the Black River, and although the manufacturing interests of Watertown are quite extensive, yet only a fractional part of this immense water power is utilized, as will be seen in the following extract, taken from an interesting book, entitled "Attractions and Commercial Advantages of Watertown, N. Y., Illustrated and Described," which was published in 1876, under the auspices of the Watertown Manufacturers' Aid Association, and edited by Charles R. Skinner.

THE WATER POWER OF BLACK RIVER.

Upon the organization of the Manufacturers' Aid Association, it was decided that a careful and scientific survey be made of the river upon whose power we base in so large a measure the distinctive attractions of our city, with a view of ascertaining in a definite and unmistakable manner, the exact measure of the power derived from the river in its passage through the corporate limits of Watertown. To this end a systematic survey was made by Mr. Frank A. Hinds, civil engineer, assisted by Mr. Fred. W. Eames, two gentlemen well calculated and abundantly qualified to do the work assigned them. We quote the following from Mr. Hinds' report:

"I have made a survey of Black River throughout the extent of the city of Watertown, and in accordance with your wishes herewith submit a report of that survey together with a map and profile.

"A level was carefully taken of the water from the point where the river enters the city at its eastern limit, to the point where it leaves it at its westerly boundary, a distance of less than two miles, including in detail all the numerous falls and rapids both improved and unimproved. The whole amount of fall within this distance I have found to be 111.75 feet. Eighty-three feet of this noticable fall is included between the upper and lower railroad bridges, as seen by the accompanying map.

"There are five distinct falls between the points named named. The river was gauged at a point about two miles above the city, where its course is straight and level for a considerable distance, and it was found to deliver 596,728 cubic feet of water per minute. This measurement was taken on the 22d of March, and although the water was very little if any higher than the ordinary winter flow, and the ice still unbroken, a deduction equal to one-third was made, to insure a safe estimate of the fair working average of the year. This allowance gives an average delivery of 397,819 cubic feet per minute. This, multiplied by 62.3 and 111.75 and divided by 33.000, gives 83,928 as the average actual horse power for the whole river in its passage through the entire city. If a still farther allowance is made of two thirds of this amount for leakage, clearance, friction and unavoidable waste, we still have 27,976 horse power, which may be regarded as effectual, and available to turn machinery.

"Aside from the unused power now which flows over the dams already built, there is an opportunity for raising a dam eight or nine feet at a point below all the present improvements, near the mouth of Cowan's Creek which would furnish between two thousand and three thousand additional and effectual horse power, and is immediately adjoining the Rome, Watertown & Ogdensburg railroad track.

"There is also on the north side of Beebee's Island, and below the falls, an excellent point for a dam, now unused, and especially desirable on account of its central location, being in the very heart of the city Three thousand effectual horse power could easily be gained here at a comparative slight expense.

"Again, at a point near the eastern limit of the city, the whole river falls abruptly fourteen feet over a ledge of rocks, offering natural advantages rarely met with for the purpose of large mechanical operations. At this point may readily be added over thirty-five hundred actual horse power that may be realized to turn machinery. This point is convenient to both lines of railways entering the city.

"Still other points along the river are susceptible of improvement in this respect though of less extent, and all accessible to excellent railroad facilities."

Considering this most favorable showing, Watertown may well challenge any other point to show similar advantages, or a like instrument of power and usefulness.

It may be here stated that those now interested in the ownership of available water rights, now unoccupied, show a liberal spirit in offering their rights to such as desire to locate here. In some cases, the owners offer to donate some of the finest water rights to manufacturers who will come here and use them. Further information upon this point will be cheerfully given upon application, and inducements offered which men of enterprise cannot afford to overlook. The feeling manifested now is, to encourage any movement to utilize all our vast water power, that nothing that can be used shall be allowed to go to waste. This is regarded as one of the most important of the many advantages offered.

Mention may also be made of the unlimited number of points along the river between this city and Brownville, four miles distant, capable of being improved, and which would yield an almost incalculable amount of water power. The river is rapid, in many places narrow, and excellent points for the erection of powerful dams present themselves in each mile of the distance.

So you see by the above, there are just claims of advantages to be derived by any who are looking for a place to locate a manufacturing business. All with whom I have chatted seem thoroughly impressed with the idea, that if the great water power was only better known, or seen to be properly appreciated, the population would be largely increased.

Maquinista.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Prest.
LYCURGUS B. MOORE, Treas.
JACKSON BAILEY, Vice-Prest.
DAVIS STRONG, Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, Mechanical Engineer.

Edition, 7,500 Copies.

The American News Company.
Publishers' Agents, New York.

The International News Company,
(Formerly the Willmer & Rogers News Co.)
11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.
Will receive subscriptions for the AMERICAN MACHINIST at 17 shillings per annum, postage prepaid.

DEALERS SUPPLIED BY
The New York News Company, New York.
The National News Company, New York.
The New England News Company, Boston, Mass.
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St. Louis Book and News Co., St. Louis, Mo.
The Cincinnati News Company, Cincinnati, Ohio.
The Detroit News Company, Detroit, Mich.
The Pittsburgh Book and News Co., Pittsburgh, Pa.
The Baltimore News Company, Baltimore, Md.
The Rhode Island News Co., Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The Brooklyn News Company, Brooklyn, L. I.
The Newark News Company, Newark, N. J.
The Northern News Company, Troy, N. Y.
The Albany News Company, Albany, N. Y.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

$3.00 a year, in advance, postage prepaid in the United States and Canada.
$4.10 to Foreign Countries, postage prepaid.

ADVERTISING.

Outside page, 35c. per line, each insertion.
Inside pages, 20c. per line, (12 lines one inch.)

EDITORIAL ANNOUNCEMENT.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

NEW YORK, AUGUST 2, 1879.

CONTENTS.

PAGE.
Improved Pipe Cutting and Threading Machine... 1
Krupp's Car Wheels... 2
Is the Indicator a Miracle. Herman Krause... 2
Extracts from Chordal's Letters... 2
Re-Modeling Valve Motions. V. Hook... 3
Self-Feeding Ratchet Drills... 4
Engineering Explanations... 4
Balanced Slide Valve... 5
Communication from W. D. Young... 5
Communication from American Watch Tool Co... 5
The Engineer (continued). Stephen Roper... 5
Literary Notes... 9
Questions and Answers... 10
Blacksmith's Drill... 6
A Wonderful British Invention... 6
Epitaph on an Engineer... 6
Steam Engineers (Part II). Chas. A. Hague... 6
Watertown—Its Manufactures and Water Power... 7
Machinists and Machine Feeders... 8
Machine Shop Wages... 8
A Machinist's Library... 8
Self-Confidence among Mechanics... 9
Compliments of the Press... 9
Manufactures... 10
Machinists' and Engineers' Supplies... 11

Occasionally we have a complaint from a subscriber who fails to receive some number of his paper, owing to some unaccountable mistake. We would be obliged to every subscriber who does not get the AMERICAN MACHINIST regularly and promptly, to notify us at once.

Machinists and Machine Feeders.

A machinist, according to Webster, is "a constructor of machines and engines; one versed in the principles of machines;" according to Worcester he is "one who constructs machines, or who is skilled in their construction." These definitions give the true meaning of the word machinist, but to a great extent it is erroneously applied to almost all who work in machine shops, or who attend to the feeding or running of a machine. A man who is not skilled in the principles of machines, or the practical manipulation of tools, can not with propriety be called a machinist, no matter how long he has worked in machine shops. A real machinist is a skilled workman, not a theoretical student of mechanism, nor one whose mechanical knowledge extends no farther than proficiency in chipping and filing castings, or feeding an automatic machine, occasionally oiling it and taking away the chips and finished product.

There are numerous large machine shops where fine and accurate machines are made, in which not one in ten of the workmen is a machinist, in the proper acceptation of the word. We are acquainted with machine shops where men have been employed in running automatic machines for the last fifteen years and longer, and yet are not machinists nor do they receive machinists' pay. They never learned the trade. Machinists, unless hard pressed for a job, won't work for the pay of ordinary laborers.

It is a fact, and one not to be proud of, that the greater body of men employed in our American machine shops are not machinists or blacksmiths, or moulders or skilled workmen in any trade. "Why," said a large manufacturer of machinery, who employs two thousand hands, to us a few weeks ago, "if we were obliged to pay all our men the rates machinists work for, it would cost us considerably more to make the machines than we get for them." This is undoubtedly the case in many shops that have the reputation of employing "a superior class of trained and skillful workmen." These shops never care to take apprentices; if they do so the unfortunate apprentice is drilled into doing some one kind of work, and kept at it as long as he will stay for the small pay he gets. Men are steadily employed doing but one class of work *at ordinary laborers' wages*, and when some of them demur, and make an effort to learn the mysteries of other departments, they are discharged and a fresh lot of outside, cheap, unskilled men put into their places. This serves to repress the ambition of all the other men who are working in the perpetual routine, or treadmill style of mechanical operations, at the lowest wages paid for muscle and endurance.

Machine shop owners are not, as a rule, over selfish or avaricious, but they look out for their own interests first, and do not exercise any overpowering solicitude for the future progress and prosperity of their workmen. Every man employed in a mechanical calling should strive to advance himself and not be drifted by the tide. We say most emphatically to all men working in a machine shop who read this, whether 20 or 50 years of age, *learn your trade if it is possible*; learn it well, even if it requires some hard sacrifices, for you will never be independent until you become skilled workmen. We have heard the argument that if the ranks of skilled workmen become filled up the supply will exceed the demand, and lower wages be the result. Let us look about and see how it is now. The tendency, as we have already explained, is to secure machinery that require no special skill to manage, permitting the employment of unskilled labor to the greatest possible extent at wages everywhere paid for such. In consequence of this, skilled workmen have grown scarcer every year because fewer are learning the trade, and because the rapid increase of manufacturing gives rise to a demand for a number of proficient machinists in every large establishment. Let mechanics qualify themselves for the best positions—for thorough master machinists are in good demand to-day, and are likely to remain so while there is a surfeit of ordinary labor.

A live machinist is out of place doing shop work where no skill is required, for he will try to throw skill in somewhere. "I had a machinist to run that screw machine," said a manufacturer of milled screws to us the other day, "and he was always poking around the machine to see how he could improve it. That man"—pointing to a sleepy looking chap crowding in the steel bars—"I pay $1.25 a day and he will do four times as much work as the machinist did."

The place for mechanical skill is where it is required, and the men who possess it take a higher rank, and secure better positions and higher wages than the plodding workman who neither reads, studies or makes an effort to become a master of the trade in which he finds employment.

Machine Shop Wages.

The rates of machine shop wages paid in various towns, which we have been publishing for several months past, have caused a great deal of comment. We have been gravely assured by proprietors of machine shops that our average daily wages for certain shops were all wrong; that shops in those localities could barely make expenses if they paid such high average rates. Let this be an explanation: When we mention the rates paid to machinists, pattern makers, boiler makers, blacksmiths, or engineers, we mean *skilled workmen*, not men employed solely to scratch castings, feed an automatic machine, run a buzz saw, or shovel coal under a boiler. There are machine shops giving employment to one hundred men, where not ten of them are skilled workmen. In mentioning the average pay of machinists in such a shop, we do not include the unskilled laborers, for their average daily stipend forms no guide for competent artisans. Our object is to give practical and reliable information both for workmen and employers, and with the best facilities at our command and the special efforts put forth in this direction, our readers may be assured they are not being treated to "estimates," but to actual facts. In some large shops most of the men are employed by the piece, and frequently the work is done by special contracts with master machinists, who in turn engage men by the piece or by the day, as best suits their management. There is no locality that we have visited where rates of wages are not firm, with an upward tendency for the best grade of skillful hands.

Bagley & Sewall, Watertown, N. Y., pay machinists from $1.75 to $3.00 per day; blacksmiths, $2.50; moulders and founders average $2.25.

Watertown Steam Engine Co., Watertown, N. Y., pay machinists $1.25 to $2.00 per day; blacksmiths average $1.75; boiler makers average $1.50; painters average $1.75: pattern makers average $1.75; helpers, $1.00.

Hitchcock Lamp Co., Watertown, N. Y., pay machinists an average of $1.75 per day.

Eames Vacuum Brake Co., Watertown, N. Y., pay machinists $2.00 per day; blacksmiths, $2.25; pattern makers, $2.50; helpers, $1.00.

Heald, Cisco & Co., Baldwinsville, N. Y., pay machinists $1.25 to 3.00 per day; founders, $1.50 to $2.75; pattern makers, about $2.00.

Bradley & Co., Syracuse, N. Y., pay machinists $1.25 to $2.50 per day; blacksmiths, $1.25 to $2.25; helpers, $1.00; wood workers, $1.00 to $2.25.

Whitman & Barnes Manufacturing Co., Syracuse, N. Y., pay machinists $1.50 to $2.00 per day; blacksmiths, $1.25 to $2.00; helpers, $1.00.

A. C. Powell & Co., Syracuse, N. Y., pay machinists $1.50 to $2.25 per day; blacksmiths, $2.00; helpers, $1.00.

Porter Manufacturing Co., Syracuse, N. Y., pay machinists $1.50 to $2.50; blacksmiths, $2.00; pattern makers, $2.00 to $2.50: founders, average $2.00.

Utica Steam Gauge Co., Utica, N. Y., pay machinists $1.75 to $2.00 per day; brass moulders, $2.00; pattern makers, $2.00; helpers, $1.00 to $1.25.

WORCESTER, MASS.

The reputation of Worcester as a machine making city has induced an influx of practical workmen from all parts of New England and some parts of the country outside. The result is palpable in an over supply of competent artisans and consequent low wages. In no other town of which we have any special knowledge can a machine shop be filled with good mechanics at as low wages as it can be in Worcester.

A cheap class of workmen may be found in almost any manufacturing district, but not able and reliable mechanics, such as Worcester is proud to possess.

Said a manager of one of their large machine shops to us lately: "I have but one man in my shop that I pay over $1.75 a day. He gets $2.00 a day."

A year ago many journeymen machinists were glad to engage at $1.25 a day; now the same men won't work for less than $1.50. The general rates for machinists come between $1.50 and $2.00 a day, the average probably ranging from $1.60 to 1.75. It is but just to mention that in the average cost of a mechanic's living, $2.00 in Worcester will go as far as $2.50 in New York or Brooklyn.

We specify rates paid in a few of the shops:

David W. Pond employs 100 men, and pays machinists rates from $1.50 to $2.50 a day.

P. Blaisdell & Co. have 65 men, and pay machinists $1 50 to $2.50 a day, the average being near $2.00 for good steady workmen; ordinary laborers $1.00 a day.

McCloud & Crane employ 14 hands in making machine screws. They pay machinists $1.50 to $2.00 a day, the average being $1.62.

The Lathe & Morse Tool Co. employ 30 to 40 men. They pay machinists $1.25 to $2.00 a day, with an average of $1.65.

Rice & Whitcomb pay machinists $1.50 to $2.00 a day; the average being $1.75.

William Allen & Sons, Worcester Boiler Works, pay boiler makers all the way from $1.25 to $3.75 a day, with an average of $2.00, or a little over; machinists, $1.50 to $2.00.

L. Coes & Co. employ 51 hands making wrenches. They pay one machinist on tools $3.50 a day, and two others, on same work, $2.75 each

A Machinists' Library.

We have had numerous inquiries as to what books a machinist and engineer should read to acquire the information he needs in his business. We have compiled a list of such books as are most desirable for him to possess. As we have no interest, either direct or indirect, in selling books, we are at liberty to give an unbiassed opinion. First of all a machinist and engineer should read the AMERICAN MACHINIST every week to keep posted on mechanical *progress*, and file it for reference. So far, we have a direct interest in selecting this kind of literature. The following books should be obtained about in the order they appear below:

Catechism of Steam Engines, by Stephen Roper, $2.00.
Experimental Mechanics, by Prof. Ball, $4.50.
Hand Book of Land and Marine Engines, by Stephen Roper, $3.50.
A Practical Treatise on the Combustion of Coal, by Wm. M. Barr, $2.50.
Lessons, in Elementary Physics, by Balfour Stewart, $1.50.
The New Chemistry, by Prof. J. P. Cooke, $2.00.
An Elementary Treatise on Steam and the Use of the Indicator, by J. C. Graham. $3.50.
The Conservation of Energy, by Balfour Stewart, $1.50.
Use and Abuse of Steam Boilers, by Stephen Roper, $2.00.
A Practical Treatise on the Movements of Slide Valves and Eccentrics, by Prof. MacCord, $3.00.
Friction and Lubrication, by Prof. R. H. Thurston, $1.50.

A Treatise on Files and Rasps, by the Nicholson File Co., $1.50.

Practical Brass and Iron Founders Guide, by James Larkin, $2.25.

Moore's Universal Assistant and Complete Mechanic, by R. Moore, $2 50.

Elementary Treatise on Heat, by Balfour Stewart, $3.50.

Handbook of the Locomotive, by Stephen Roper, $2.50.

Catechism of the Locomotive, by M. N. Forney, $2 50.

Link Valve Motion, by W. S. Auchincloss, $3.00.

A Treatise on Steam Boilers, by Robert Wilson, $3.00.

Modern Practice of American Machinists and Engineers, by E. P. Watson, $2.50.

The Mechanics' Tool Book, by W. B. Harrison, $1.50.

A Treatise on the Use of Belting, by Cooper, $3 50.

It is but just to remark that good practical books on Steam Engineering are not rare; but there is abundant room for a few modern books on the best machine-shop practice.

Self-Confidence Among Mechanics.

As a general thing, this peculiar and essential qualification is lacking, particularly among machinists. How often have we observed one of this class scratching his head over his work, his tools lying beside him, and, on the whole, a perfect picture of despair, or, as the boys in the shop say, 'stuck.' Suppose we speak to him, and try to help him out of his trouble, what is the result? He replies, "Oh, I have tried this thing for over an hour, and I tell you the d——d thing won't work. It is no use trying." Such is a clear illustration of the shop practice of the present day. As we were walking the floor of a shop one day, we stopped near a drill press, upon which a man was at work, drilling the edge of a crown sheet for a boiler. The sheet was lying horizontal, and the drill press, which was driven by a rope, was adjusted to suit the work.

We noticed that it took a very long time to drill a hole through the sheet, which was but 7-16 of an inch thick, and the man was very much excited over his work. We inquired what was the matter. He simply repeated the language previously mentioned by us, viz., "The d——d thing won't work," We asked if he had ground his drill; he answered, yes. We added, "What can be the matter?" and when we saw that he was completely 'stuck,' merely told him to change the rope-belt so as to run the drill press the other way. The fact was, that he had become so much perplexed over his work that he did not notice that he had placed the belt wrong, and at the time of our observing him, was actually running his drill the wrong way, or left-handed.

He did as he was directed, and went on with the work rejoicing. We might mention many other just such, or similar instances, but this is sufficient to illustrate the "I can't" disposition which sometimes exists in the machinist. Now for an example the direct opposite of the one just mentioned:

A machinist applied to the master mechanic of a railroad for a situation. The master mechanic asked him (as is the usual custom) what he could do. "Oh, I can do anything; I'll not turn my back on any man that ever lifted a hammer; I can build a locomotive, put it together, and run it." "Very well" said the master mechanic, "so you are an engineer, are you?" "Well, I should say I was" The master mechanic said, "You can come here to work; go over the road and learn it, and then we will give you an engine to run." Accordingly the man went to work, and in due time was placed in charge of an engine. All went on well for a while, when, one day he was running a coal train; everything about the engine was working nicely, and the train making about 20 miles per hour. A loud report was heard; when the train was stopped, and an examination made, it was found that a large plug about four inches in diameter, which had been screwed into the front end of the steam chest, had been loosened by corrosion, and finally blown out. We were not far from the place at the time the accident occurred, and so walked leisurely down to the train to see what was the trouble. The engineer was flying about like a rooster with his head cut off, and upon reflection, proved to be the identical chap that had made use of the assertion, that he could do anything in the way of building or running engines.

We saw at once that he would not be likely to get out of trouble himself without assistance, for he was upon the point of telegraphing for an extra locomotive to help him out of his difficulty, when we arrived upon the ground. As he was starting off we called him back, and offered to help him if he would accept of our assistance, when, much to our surprise, he was willing to accept anything, or do anything, whereby he might be spared the humiliation, which would be sure to follow should he send for assistance. We suggested that a plug be made of soft pine, of which there was plenty in the vicinity, and driven into the hole, which was done. We then got a short piece of timber, cut it to the proper length, and placing one end against the plug and the other against the bumper, forced it in tight, the operation occupying about twenty minutes. Our skillful engineer then mounted the engine, pulled out the throttle, and ran (as we learned afterwards) over forty miles, and could have run forty more, making the same time as he would have done if there had not been a wooden plug driven into the steam chest. It is, perhaps, necessary to add that this experience had a remarkable effect on the engineer mentioned, by lowering him in his own estimation.

It is very plain that neither one of these two extremes will assist a man in his onward progress towards filling a responsible position, and while the former will prevent a man from rising, the latter has a tendency to degrade him. What course then is the mechanic to pursue?—and this we address particularly to mechanics. First of all then you must remember that the world is older than you are, and for thousands of years has been full of men smarter and better probably than yourselves, and when they died the world did not stop, but business kept on and in a short time they were remembered only by a few intimate friends. Not one in ten millions ever heard of their death even. We say to you: Be as smart as you can, and push yourself forward as fast as possible without blowing the packing out of your cylinder heads; let people know that you are posted, but don't dazzle their eyes with your knowledge. Don't state a thing for a fact simply because you have an idea that it is, but carefully investigate the subject before asserting it, and thereby spare yourself any humiliation.

Always look on the bright side of everything, and don't waste your time by picking your shopmates to pieces, for the worst obstacle that a mechanic has to contend with is the jealousies of his shopmates. Above all things avoid becoming a chronic grumbler. Do your work as if it were a pleasure and soon you will be surprised at the progress you have made. We have heard it stated that it is an easy thing to make proverbs such as Solomon wrote, and we say to you *make a few.*

The world's business has great need of good, steady mechanics, and the mechanics have great need of the world. Remember that this is an age of learning, when books can be bought for a trifle, and you have ad vantages that George Stevenson and all the old school engineers would have jumped at.

Your clothes are cut in a more becoming pattern, your collars fit neater, and, altogether, the mechanics of to-day are finer looking men, when dresssed up, than were those of fifty years ago. Do not jump for a big salary at once, but take things cool, and prosperity will be likely to follow. Do not pass your time dreaming of the future, but live for the day and press toward the future. Don't be so modest as to shut yourself clear out, but don't be so fresh that you will have to be put away in a cool place to keep from spoiling. Do not be afraid your merit will not be discovered. People all over the world will be hunting for you, and if you are worth finding, they will find you. A diamond is not as easily found as a quartz pebble, but people will search for it all the more intently.

We know whereof we speak for we have been there.

Compliments of the Press.

(*From the Watertown (N. Y.) Daily Times.*)

THE AMERICAN MACHINIST.—This well-known publication, which has met with so much favor among the craftsmen whom it represents, has been compelled to change its issue from a monthly to a weekly journal. THE MACHINIST is illustrated in the most elaborate manner, and elegantly printed. It is published by the Machinist Publishing Co., 96 Fulton Street, N. Y., at $3 per year. It should be in the hands of every inventor, machinist, engineer, founder and boiler-maker in the country, who desires to keep up with the times.

(*From the Era, New York.*)

THE AMERICAN MACHINIST.—Although at present only in its second volume, this admirable publication has been so successful in finding a market that in the number dated June 28th, we find it changed from a monthly to a weekly. This is a daring step, but it is a satisfaction to know that the publishers are warranted in taking it. THE AMERICAN MACHINIST is devoted to exploiting subjects appertaining to mechanical industry, to illustrating and describing new inventions, and to acquainting mechanics not only with the uses of machines, but with the science and philosophy of machinery. To say that THE MACHINIST subserves its purpose to the satisfaction of that class of the public to which it appeals, is merely to credit its patrons with good taste and appreciation. It is to be hoped that a continuance and increase of such patronage will accompany its progress under its "new departure."

(*From the Cincinnati Artisan.*)

A noteworthy event of class-journalism in the change of the AMERICAN MACHINIST, of New York, from monthly to weekly publication. The monthly ranked the highest as a strictly mechanical paper, and we have no doubt that the change will only add opportunities for a display of the editorial and managerial capacities of the officers of the Publishing Company.

(*From the Westfield (Mass.) Advertiser.*

THE AMERICAN MACHINIST changed June 28th, from monthly to weekly, which cannot but give great satisfaction to its numerous patrons. It has also increased its active editorial and business corps, and added $50,000 to its capital. It is a live paper and of especial value to all interested in machinery. $3 a year. Published by the American Machinist Co., 96 Fulton Street, N. Y.

LITERARY NOTES.

THE USE OF THE STEAM ENGINE INDICATOR, OR PRACTICAL SCIENCE FOR PRACTICAL MEN. By Edward Lyman, C. E., of New Haven, Conn. Cloth $1.

This work consists of 95 printed pages, with an addition of 16 diagrams, and contains an account of the author's experience on the use of the indicator, in correcting and improving the economical efficiency of steam engines, illustrated by the numerous diagrams mentioned. These diagrams are engraved, and most of them have been taken from actual practice from marine and stationary engines. The author of this book starts out with the principle that it matters very little for the scientific principles upon which these things are based; "results" are what the manufacturer and the practical engineer wants.

Satisfy any sane man that he is burning two pounds of coal where one pound would do the work, and advise him of the best means under the circumstances of bringing about the reduction, and so far your duty is done, and you are justly entitled to the measure of praise of him "who makes two blades of grass grow where one grew before." This work shows plainly the difference between good and bad diagrams as they are selected from the regular practice of the author, with reference to the special business in hand, and any person who is operating with steam as a motive power may peruse the pages of this book with pleasure and profit.

We have received from Geo. B. Dixwell, No. 553 Shawmut Avenue, Boston, Mass., a pamphlet containing a report of the engineers of the U. S. Navy upon experiments with saturated and superheated steam, made at the Massachusetts Institute of Technology. This work is illustrated by numerous diagrams, and contains some valuable tables by Geo. B. Dixwell.

We have also received from the same source a pamphlet containing a paper on Cylinder Condensation, Steam Jackets, Compound Engines, and Superheated Steam, by the same author. This work also treats exhaustively on the subjects mentioned, and is illustrated by numerous diagrams. Mr. Dixwell has made numerous discoveries during his experiments, among which may be mentioned the application of a pyrometer to the cylinder for the purpose of indicating the temperature inside, also the using of superheated steam for motive power and adapting and regulating the amount of superheating desirable in each special case, according to the indications of the pyrometer placed in the cylinder.

Mr. Dixwell has also an improved superheating system to be applied to the furnace of steam boilers; and can be seen at the Massachusetts Institute of Technology where the boilers are fitted so as to work the engine with or without superheated steam.

These pamphlets throw a great deal of light upon the subjects concerning superheated steam which are generally considered as speculative.

The *Furniture Trade Journal* of Chicago and New York, now in its VIth volume, has recently changed from a monthly to a semi-monthly publication, the change being induced by successful business. The F. T. J. is a capitally good paper, and is wide-awake to everything that the furniture people of the period want to know. It contains original illustrated articles on Design and Decoration, which cannot fail to interest its readers. It is very finely printed, and well edited. Published by F. B. DeBerard & Co., 70 Dearborn Street, Chicago, and 287 Broadway, New York; subscription price $1 per year.

The last (8th) edition of "The Universal Assistant and Complete Mechanic," published by R. Moore, 20 Cooper Institute, N. Y., is exhausted, and another is now being issued.

When the report of the Swiss Centennial Commissioner on American watch-making was read to crowded meetings of watch-makers at Neuchatel and Geneva, the general expression was one of abject despair. Work was suspended on the Genevese School of Watch-making then being erected, and the Canton Council appointed a committee to consider what other industry could be introduced in place of watch-making.

Business Specials.

Thirty cents a line for each insertion under this head.

For Screw Cutting Engine Lathes of 14, 15, 18, and 22 in. Swing, address Star Tool Co., Providence, R. I.

The Huntoon Steam Governor Co., of Lawrence, Mass., warrant a direct saving in steam of from 10 to 20 per cent. over any other Governor known; while for quick and accurate regulation, great durability and lasting economy in use, they guarantee results never before attained by any other. See advertisement.

Brown & Sharpe M'f'g Co., Providence, R. I., keep in stock at reduced prices Patent Cutters for the teeth of gears which can be sharpened by grinding without changing their form. All wheels of same pitch cut with them will run together correctly. Send for new catalogue.

National Steam Pump, simple, reliable and durable. Send for illustrated catalogue with reduced price list. W. E. Kelly, New Brunswick, N. J.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) W. G., New Orleans, La., writes: In the column of questions and answers, in your issue of June 28th, I read in Inquiry (No. 5) G. J. G. question (No. 2)—Which contains the most water—a cubic foot of steam at ten pounds pressure, or a cubic foot of steam at eighty pounds? Your answer was: "One cubic foot of steam at ten pounds pressure." My answer would be as follows: "One cubic inch of water will make 1,728 cubic inches of steam, under the pressure of one atmosphere. Therefore, a cubic foot of steam will contain one cubic inch of water for each atmosphere of pressure." For, since eighty pounds contains 6⅓ atmospheres (fifteen pounds)—one atmosphere not being indicated—a cubic foot of steam at eighty pounds pressure will contain 6⅓ cubic inches of water By the same rule, ten pounds pressure being 1⅔ atmospheres, a cubic foot of steam at ten pounds will contain 1⅔ cubic inches of water. Question (3): "Can you increase the pressure of steam by heating it (say one cubic foot of steam at ten pounds pressure, placed in a suitable apparatus for heating) could you raise the pressure to twenty or thirty?" My answer would be as follows: The full expansive power of water is given out in its transition into steam (no matter what pressure) and it cannot be expanded by additional heat. Several years ago I had occasion to test this subject, and found the experiment very instructing and entirely free from danger. I heated a wrought iron vessel red hot all over, which contained 100 lbs pressure, and obtained no additional pressure whatever by the additional heat. Of course, I was very careful to allow the steam to blow through the vessel for the purpose of expelling the air and accumulated water before superheating.

(2) I. M. E., U.S.S. Ajax., Brandon, P.O. Va., writes: The following question is a question of altercation, and left to your weekly to decide. Steam cylinder 100 inches diameter; steam jacket 103 inches diameter; pressure of steam, 90 lbs. per square inch. What should be the thickness of metal of the cylinder, also the thickness of metal of jacket? Please give recognized rule for finding thickness of such cylinders. A. There is no standard rule that we are aware of, that would apply to your particular case. In designing a cylinder the amount of iron put into it is not of so much consequence, on account of strength, as the surety of getting a good sound casting, for iron is always used in excess of the strength required, for the foregoing reason. It is also governed by the shape of the cylinder, number and thickness of ribs, also size and shape of steam jacket. The judgment of a good practical man is necessary in a case like this, and is worth more than all the books in existence, for a few pounds of iron is a very small item compared to the loss of a whole casting, on account of cracks. We know of cases similar to the one that you refer to, where the cylinder was made from 2¼ inches to 2⅛ inches thick, allowing 3-16 of an inch to be bored out all around.

(3) W. W. H., Brooklyn, N. Y., asks: Will you please to explain to me, through your paper, the principle upon which the railway air brake works, and oblige a young subscriber? A. The principle of the air brakes used upon railway cars and locomotives is worked upon the principle of compressing air in a reservoir (one or more) by means of an air pump worked by steam, and using the power thus accumulated in small cylinders, one of which is placed under the center of each car, whereof the piston is connected to the levers of the brakes, and communicating the power to them by which they are applied. This power is placed thoroughly under control of the engineer by means of a short handle attached to a three-way cock, and by turning it the brakes are applied, controlled or released at pleasure.

David W. Pond, Worcester, has just published an illustrated catalogue of his latest improved machine tools. It contains 32 pages prefaced by the following announcement:

"Your attention is invited to enclosed illustrations and descriptions of tools, which have been made from entirely new and carefully-studied designs, and are intended to meet the present demands of the trade, which calls for strong, accurate and durable machines, with increased capacity for quantity of work, and additional conveniences for giving operator command of his machine, to effect saving of time in adjustment, without complication or liability to get out of order."

The *Boston Commercial Bulletin* says: There is a great demand for first-class machinists, and, as the busy season has hardly begun yet in this trade, it is anticipated that there will be an advance in wages in the early fall. In fact in this vicinity, all classes of steady workmen are in demand. A contractor who needed a force of ordinary day laborers, scoured South Boston, and, with difficulty obtained the number he needed at $1.40 a day, an advance of 15 cents a day.

Manufactures.

Bagley & Sewall, Watertown, N. Y., are running full time, employing 65 hands, and have plenty of orders ahead.

Watertown Steam Engine Co. are very busy running on 12 hours' time, employing 100 hands, and have plenty of orders ahead.

Eames' Vacuum Brake Co., Watertown, N. Y., are full of orders, running full time, and employing 30 hands. Their business is growing largely.

Hitchcock Lamp Co., Watertown, N. Y., are running full time, and have plenty of orders ahead. They shipped 150 of their Mechanical Lamps to England last week.

Heald, Sisco & Co, Baldwinsville, N. Y., are employing 25 hands, running on full time. Have plenty of orders ahead, and report business in a flourishing condition.

Porter Manufacturing Co., Syracuse, N. Y., report trade good, have plenty of orders, running full time, and employ 125 hands.

Utica Steam Gauge Co, Utica, N. Y., are employing 18 hands on full time, report business good.

Bradley & Co., Syracuse, N. Y., are extremely busy; are employing 150 hands, and running full time. They shipped last week, three of their trip-hammers to New Haven, two to Middletown, one to Chicago, and one to Manchester, England, and have a number ordered ahead, but not yet completed.

Whitman & Barnes' Manf'g. Co., Syracuse, N. Y., are very busy, running full time, and employing 200 hands.

Rice & Whitcomb, Worcester, are about to publish a new illustrated catalogue of tneir machinery.

P. Blaisdell & Co., Worcester, are employing sixty-five men on machine tools, and find business brisk.

The Worcester Machine Screw Co. are full of orders, and keep all of their machines in operation full time.

Wm. Allen & Sons, Worcester, will place a No. 10 Victor Feed Water Heater and Purifier in the Cincinnati Exhibition this fall. It will be in use to heat and purify the water for a 200 h. p. boiler, which furnishes steam for the motive power.

The Whittier Machine Co., Boston, employ 100 men and find business brisk in engines, boilers, and elevators.

John F. Wood, President of the Union Stove Co., Boston, has patented a new and valuable treadle for foot power. For illustrated description, see a future issue of the American Machinist.

W. H. Warren, Worcester, has just completed nine special machines for one party.

L. Coes & Co., Worcester, have run their factory over-time, from one to three hours a day, since Feb. 1. They employ fifty-one hands and made 18,510 wrenches a month for two months past. They are now behind orders. During the last six months their export trade has developed into an extensive business with Germany, England, Australia, France and Brazil, the first named country being the best customer.

The American Tool and Machine Co., Boston, employ, at present, 160 hands in their several departments. They are making considerable sugar machinery.

The Star Tool Co., Providence, R. I., are about to build a new shop to accommodate their growing trade. It is expected to be completed in the fall. They will then add to their various sizes of engine lathes, of which they make a specialty.

J. S. Wheeler & Co., Worcester, Mass., who have given their whole attention to jobbing for many months past, have resumed the manufacture of machine tools.

Some of the new iron planers will appear on the market in the course of a few months. Experiments are now being made.

Waterproof, La., is to have a cotton-seed oil mill.

Lynn, Mass., is to have a nail factory.

Blue Spring, Nebraska, will have a woolen mill.

The Enterprise Boiler Works, Chicago, have orders several months ahead.

The Providence Dyeing, Bleaching & Calendering Company are re-setting the second Corliss boiler with the Jarvis Setting.

W. H. Robinson, Shelbyville, Ind., is erecting a new planing mill.

The Albion Paper Co., Holyoke, Mass., have nearly completed their new mill. It will employ 225 hands and make ten tons of paper a day.

Geo. West's paper mill at Ballston, N. Y., is rapidly approaching completion.

C. Shaler Smith, civil engineer of St. Louis, has about completed the plans for the new machine shops of the Chicago, Milwaukee & St. Paul Railroad at Milwaukee. It is the intention of the road to build the finest shops on the continent. They first sent their master mechanic off upon an inspection tour through the East and then gave him *carte blanche* to order the best that could be built. The new shops will consist of one round-house of 44 stalls and three shops. There will be used in their construction 1,500,000 pounds of iron.—*St. Louis Railway Register.*

The Barney & Smith Manufacturing Co., of Dayton, O., are enlarging their foundry 100 per cent., and otherwise increasing their capacity by the addition of new and improved machinery. It will be remembered that this company, but a short time ago, increased their power 50 per cent. by the addition of a large and powerful engine. The amount of work turned out this year, and now in course of construction, far exceeds that for a corresponding time of any year in their history.

The Continental Bolt Works, corner North Franklin and Michigan streets, Chicago, report a rushing business. They are over a hundred tons behind orders in Chicago alone.

The Pullman Palace Car Company is building 100 cars for the New York Metropolitan Elevated Company at its shops in Detroit.

The Brainard Milling Machine Company, of Hyde Park, Mass., have recently shipped two 'Universal" milling machines to the Government workshops at Stockholm and one to the arsenal at Eskilstuna; they are also building one for the Russian Government, and one is nearly completed to go to Troyes, France. They have sold milling machines this year to Russia, Germany, Sweden and England.

The Abbott Downing Company, of Concord, N. H., manufacturers of wagons, coaches and carriages, are now employing about 200 men, some 20 of whom have been continuously in the company's employ from 29 to 45 years. This company commenced business in 1813. In 1868 a single shipment of thirty of their coaches was made to Wells, Fargo & Co., for service on their overland route. Branches are established at Boston, New York, Chicago, San Francisco and Melbourne. The company are now completing a building in New York City for a depository.

The new building of the Willimantic Linen Co., at Willimantic, Conn., will contain 10,000 spindles.

An Engine of 500 horse-power is to be placed in the new mill which is being built by the Manchester (New Hampshire) Corporation.

A large elevator and warehouse is being erected by the Crown Mills Company, Belleville, Ill.

It is announced that the Rutland Scale Works Company, Rutland, Vt., has recently secured a large amount of additional capital by the purchase by a New York firm of $75,000 in stock and $50,000 in bonds.

The Lake Company of Laconia, N. H., are preparing to build a three-story-mill, 104 by 40 feet.

Brookville, Ind., is making arrangements to build water-works.

The capacity of the Elmira Rolling Mills, at Elmira, N. Y., is to be doubled, and the company are to engage in the manufacture of bridges.

Silas Barkley has commenced the erection of a new flour and grist mill at Hulmeville, Bucks County, Pa.

The Blair & Fiske Manufacturing Company is a new concern in Springfield, Mass., reorganized from the Springfield Lawn Hose-Carriage Company. They are to engage in the manufacture of lawn mowers, lawn hose-carriages, sprinklers, etc.

The Cooper Manufacturing Co., Mt. Vernon, Ohio, have recently received an order from Gustav Schranke, of North Freedom, Wis., for an engine, boiler, etc., to put in his mill, and to take the place of water power.

A new stock company, with a capital of $25,000, has been formed at Westfield, Mass. It is to be called the Westfield Power Company, and the following officers have been elected: President, M. B. Whitney; Treasurer, M. E. Searle; Superintendent, L. C. Gillett; Directors, Whitney, Gillett, Thomas Little, Henry Loomis, Lyman Peebles, D. N. Lane, William Provin.

Business in South Easton, Pa., is just at present looking up; all the wire mills, cotton factories and rolling mills are in full operation. The Lehigh Valley shops are being run with a full complement of hands, and comparatively but few idle men are seen upon the streets.

The Troy Steam Heating Co., Troy, N.Y., have the foundation of their boiler house nearly completed. They have awarded the following contracts: For the boiler house, Button & Buckley, mason work; Boughton & Abrams, carpenter work, including coal shed; P. Costello, of West Troy, docking; Porter Manufacturing Co., of Syracuse, boilers; Knowlson & Kelley, machinery; Reading Iron Works of Penn., wrought iron pipes; Tonawanda Pipe Works of Tonawanda, N. Y., logs to encase pipes; Asbestos Patent Fibre Co, of Philadelphia, asbestos; Baeder, Adamson & Co. of Philadelphia, hair felting; R. T. Smart, Brother & Co., paper covering.

The Cope and Maxwell M'f'g Co. of Hamilton, Ohio, have recently contracted with Delos A. Chappell, of Chicago, Ill., contractor for the Trinidad Colorado Water Works to furnish one set of their Isochronal Duplex Compound Non-Condensing Pumping Engines and Boilers complete. The engines and pumps are horizontal. The capacity requirement is 2,000,000 gallons, 330 feet high per 24 hours. Steam is supplied to the high pressure cylinder at a pressure of 125 pounds per square inch, and is exhausted into a receiver, from which it passes into the larger cylinder; the exhaust from this cylinder passes through a feed-water heated to the atmosphere. Each steam cylinder operates its own pump, which is of the plunger variety. The boilers to be of steel.

The Woonsocket Machine Co. are making preparations to erect a large machine shop near the site of their factory at Fairmont.

Sixty thousand dollars have been subscribed for rebuilding the old Jessup & Laflin Paper Mills at Westfield, Mass., burned over a year ago.

Varney & Bagley are building a three-run steam mill at Odessa, Mo.

Blue Springs, Mo., is soon to have a three-run steam flour mill.

H. P. Beattie will proceed at once to rebuild his flour mill in Davenport, Iowa, recently destroyed by fire.

The Harrisburg Foundry and Machine Co. have recently resumed operations. They do a general machine business. At present they are manufacturing portable farm engines, the Cummings vise, cast-iron and globe valves. They make a specialty of boilers and tanks.

Workmen have begun clearing ground for the erection of D. H. & J. C. Newton's new pulp mill, at Holyoke, Mass.

It is rumored that an iron and brass foundry is to be built at Natchez, Miss.

During the past year the Baldwin Locomotive Company has filled orders from India, Germany, France, England and Australia, and still the demand for American manufactures increase.

The Edgar Thomson Steel Co., Pittsburgh, is having ten boilers, each 65 feet long, built of its own Bessemer steel, and the Crescent Steel Works are having boilers built from their own crucible steel.

The Flanders & Lang Pump Co. has been organized at Burlington, Vt., to carry on the business of manufacturing the "Flanders" pumps which for some time have been constructed at Vergennes by the Vergennes Machine Co. William H. Lang is superintendent and constructing engineer of the new company.

All the factories at Bennington, Vt., are in active operation, and several of them are running extra hours.

The Wheeler & Wilson Sewing Machine Co. are running their works at Bridgeport, Conn., twelve hours a day. They are now ten pairs of machines behind in their orders.

The New York, New Haven and Hartford Railroad shops at Hartford have turned out 159 of the 200 new freight cars, which were begun there the 3d of May.

Baumann & Lotz, of Chicago, are now engaged as architects and engineers, for the design and erection of the largest grain elevator in that city. It will have a capacity of two millions of bushels, and 26 elevators therein will be driven by an 850 H. P. engine. The structure is for the firm of Armour, Dole & Co.

The moulders, one hundred and forty in number, employed at the Reading Hardware Works, Reading, Pa., struck for higher wages at the close of business on the 12th ult. The proprietors notified them the works would be closed one month. At a meeting of the moulders during the evening, it is rumored, a general strike was ordered, to commence Monday morning 14th. About one thousand moulders are employed at various hardware works and foundries in the city.

The Ansonia Clock Manufacturing Company are to employ about a thousand hands at their new factory at South Brooklyn. The main building will cover sixteen lots of 25x 100 each. In addition to this, other structures or outbuildings are to be erected in the rear which will occupy nearly as much ground. The estimated cost of buildings and machinery is about five hundred thousand dollars.

Nordyke & Marmon Co., of Indianapolis, Ind., are manufacturing a two-run mill, to be driven by an Atlas engine, for A. W. Althouse, of Osage Mission, Kan.

Wm. H. Patterson, of Smithville, Mo., is replacing his water-wheels with a forty horse power engine, built at the works of the Great Western Manufacturing Co., Leavenworth, Kan.

The Cooper Manufacturing Co., Mt. Vernon, Ohio, have recently furnished Joseph Brooks, Navasto, Texas, a new engine, boiler, and machinery for his mill. They are also enlarging and putting new machinery in the mills of John Haas, Monroeville, Ohio; Richard Douglas, Crocket, Texas; Dagon & Schlagal, Black Creek, Ohio; Tape & Rutledge, Algonquin, Ohio; Geo W. F. Sanders & Co., Bozeman, Montana; W. H. Dodge, Mishawaka, Ind., Heaton & Sigler, Richirondale, Ohio.—*American Miller.*

The Portsmouth (O.) Foundry & Machine Works lately shipped to New Orleans four boilers, each 42 inches diameter, and 26 feet long.

The Great Western Manufacturing Co., of Leavenworth, Kan., are building an engine and elevator for A. Latshaw & Co., at Wilson, Kan.

The Fulton Iron Works, St. Louis, have the contract for making the castings of the compresses being built for S. B. Steers, of New Orleans. George Fritz, of the Central Iron Works, is making the double reversing engines to work the levers of the compresses.

Thos. Prosser & Son, 15 Gold St., have received from Krupps' factory in Germany a steel crank shaft 37ft. long, 15in diameter at the large end and tapers to 13in. diameter at the small end. Weighs about 10 tons. This remarkable specimen of forging has been forwarded to Pittsburgh, Pa., to be used on a stern wheel tug boat.

The Gautier Steel Co., Limited, of Johnstown, are building an additional span to their rolling mill, 160 feet long by 65 wide, in which will be put several double presses for shearing plow-plates, and a 2,500 and 3,500 pound steam hammer. They have just finished a stock-shed for keeping a stock of blooms, and breaking up steel for rolling, covering 12,000 square feet, which will make the total area covered by their buildings about five acres.

The Keystone Bridge Co., Pittsburgh, will shortly start up the Fort Pitt Iron Works. They have the contract for the new superstructure of the Niagara Suspension Bridge and other large orders.

The new Dean pumping engines of the Nashville, Tenn. water-works are completed, and will soon be tested by the city. The Nashville *Banner* of the 24th ult. says: "If the expert makes a favorable report, we will then be the owners of what now promises to be the finest pumps in the South.

The Holyoke, Mass. Water-Power Company are building for Sanborn & Moody, a 45 by 40 feet two-story brick factory for the manufacture of roll and bed-plate knives for paper mills. They are also building a 49 by 40 feet two-story brick adition to Mackintosh's dye-house.

Railroad locomotives and cars are very low just now. Some of the best engines can be bought for $7,500. A few years ago they cost $14,000. Box cars which sold before the war at $650 are now purchased for $400. The locomotive and car building manufacturers are all busy, but complain of low prices. *The Railway Review.*

The rail mills, iron and steel are literally crowded with business, and purchasers have to place their orders some two months in advance of their needs. This is a very encouraging indication of returning prosperity.—*Railway Age.*

Machinists' and Engineers' Supplies.

Trade is good for midsummer—railroad companies are making more liberal purchases than for many months past. A new drill-chuck, by a Brooklyn machinist, will shortly make its appearance on the market.

H. Prentiss & Co., 14 Dey st., N. Y., are bringing out a new malleable iron monkey wrench—all iron—dispensing with the use of a wooden handle; intended for outdoor use, or where tools are liable to be neglected. Claimed about 25 per cent. cheaper than wooden-handled wrenches.

A new steam engine indicator will be offered to the public in a few weeks at a reasonable price.

Lathrop's Self-Feeding Ratchet Drills are offered by the mannfacturer, S. Park Lathrop, Newark, N. J., at the following prices: No. 1, 10-in. handle $8; No. 2, 12-in. handle, $10; No. 3, 15-in. handle, $12; No. 4. 18-in. handle, $14. The boiler ratchet sells at $8 for 10-in. handle, and $10 for 12-in. handle.

David Pond, Worcester, Mass., has issued a new illustrated catalogue of machinist's tools. The Brainerd Milling Machine Co., Boston, are preparing a new illustrated catalogue. The Betts Machine Co., Wilmington, Del., are about to publish a new illustrated catalogue of machine tools. Rice & Whitcomb, Worcester, Mass., are about to issue a new illustrated catalogue of their punching, shearing and stamping presses.

The Labrador Oil Stone Co., Syracuse, N. Y., are introducing a newly discovered sharpening stone for machinists and others. They claim that it is "the quickest and best sharpening stone in the world," and present in their circular a strong array of testimonials from parties who have used them. Their prices range at 30c, 40c, 50c, 60c, 70c, 80c, and $1 a pound; needle pieces, $10 a hundred They have also a price list for Labrador Oil Stone mounted in black walnut cases.

WANTED—SITUATION.

Have had 1½ years experience in making Surgical Instruments. Wish to learn the machinist's trade. Best recommendations. Chas. E. Eisile, 95 E. 8th St., New York.

NICHOLSON FILE CO.
SOLE MANUFACTURERS OF
FILES AND RASPS
HAVING THE INCREMENT CUT.
Also, FILERS' TOOLS and SPECIALTIES.

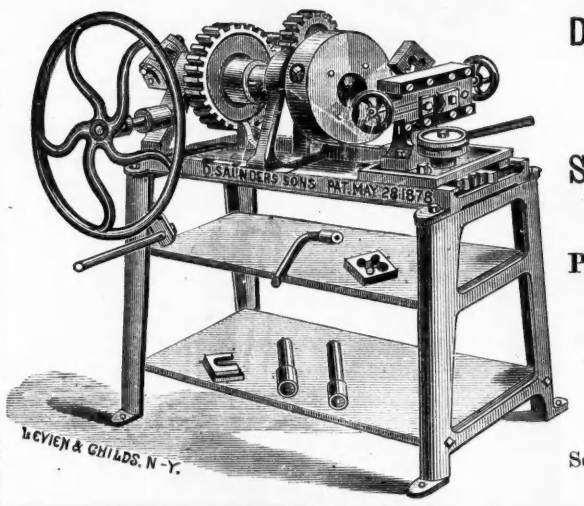
"Nicholson File Co's" Files and Rasps.	
"Double Ender" Saw Files.	File Brushes, File Cards.
"Slim" Saw Files.	Surface File Holders,
"Racer" Horse Rasps.	Vise File Holders.
Handled Rifflers.	Stub Files and Holders.
Machinists' Scrapers.	Improved Butchers' Steels.

Manufactory and Offices at PROVIDENCE, R. I., U. S. A.

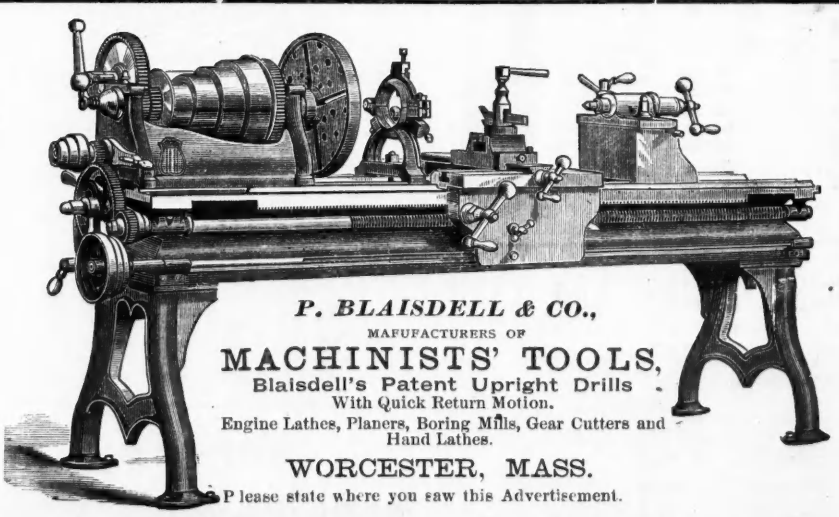
W. S. MIDDLETON,
BROKER IN
Railroad, Mining and Steamship Supplies,
MACHINERY, HARDWARE AND TOOLS
of every description.
52 JOHN STREET, NEW YORK.
☞ Manufacturers of Machinists', Engineers', Railway and Mining Supplies of every kind are requested to send me their latest catalogues and trade prices.

NORTON'S
Solid Emery and Corundum Wheel.
The Best Solid Wheel in use. Will not Glaze, Heat, nor smell, and will run equally well, Wet or Dry.
SATISFACTION GUARANTEED OR NO PAY.
F. B. NORTON, Patentee and Manufacturer,
No. 41 Water Street, Worcester, Mass.

THE·STOW·FLEXIBLE·SHAFT·CO·LIMITED·
As this shaft transmits power through any number of curves, its value in the railroad and general machine shop, is at once apparent. We have designed, and keep in stock, a series of special tools for use with the shaft, as:- PORTABLE DRILLS for metals; AUGER CHUCKS for wood; CLAMPS for emery and buffing wheels, etc. CATALOGUE and PRICE LIST, on application.
500·NORTH·FIFTEENTH·ST·PHILADELPHIA·

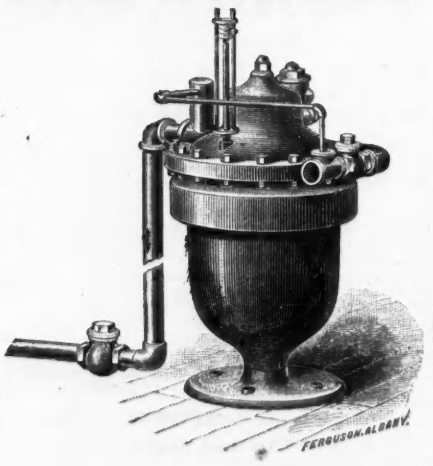


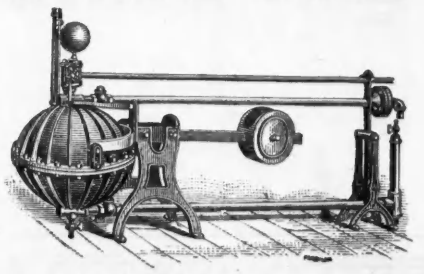
D. SAUNDERS' SONS,
Yonkers, N.Y.,
Manufacturers of
Steam and Gas Fitters'
TOOLS,
Pipe Cutting & Threshing
MACHINES
For Pipe Mill Use, &c.,
A SPECIALTY.
Send for Circular, and say where you saw this advertisement.



P. BLAISDELL & CO.,
MAFUFACTURERS OF
MACHINISTS' TOOLS,
Blaisdell's Patent Upright Drills
With Quick Return Motion.
Engine Lathes, Planers, Boring Mills, Gear Cutters and Hand Lathes.
WORCESTER, MASS.
Please state where you saw this Advertisement.

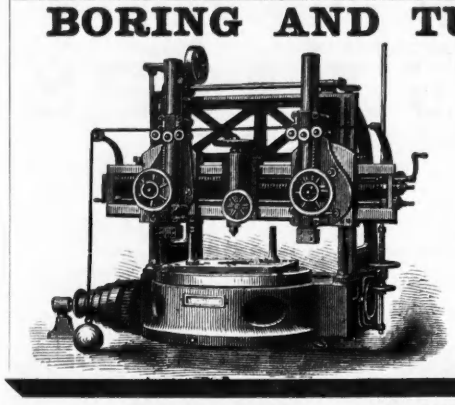
THE ALBANY STEAM TRAP.





This Trap automatically drains the water of condensation from HEATING COILS, and returns the same to the Boiler, whether the coils are *above or below* the water level in Boiler, thus doing away with pumps and other mechanical devices for such purposes.
Apply to
Albany Steam Trap Co.
ALBANY, N. Y.

BORING AND TURNING MILLS.



All Sizes: 4, 5, 6, 8, 10, and 12 feet Swings.

PATENTED IMPROVEMENTS.

New Patterns.

MACHINISTS' TOOLS,

The Latest and Best, at very moderate prices.

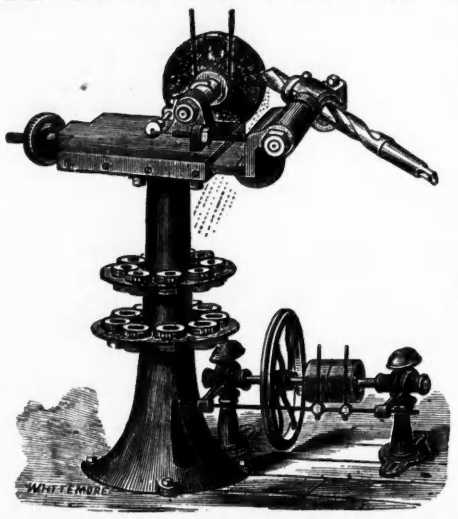
NILES TOOL WORKS,
HAMILTON, OHIO.

WM. H. EDDY,

WORCESTER, Mass.

Manufacturer of the Best and Cheapest

TWIST DRILL GRINDING MACHINE in the World.



☞ Requires no skilled workman to run this machine. Either Crooked or straight drills ground quickly and accurately.

This Machine grinds drills to the same shape as the best machinists do by hand. It enables the operator to make the cutting edge or lip of the drill thick and strong so it will not crumble away in drilling, also to make the lip true with the twist or outside surface

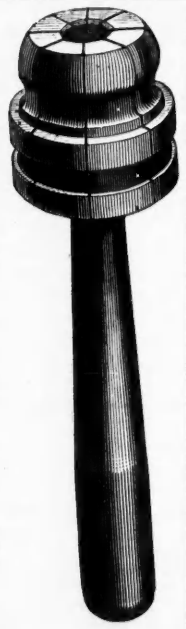
☞ Send for Prices and Testimonials.

THOS. PROSSER & SON,

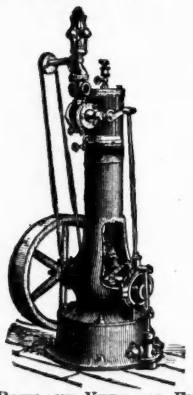
15 Gold St., NEW YORK.

"Prosser" Boiler Tube Expanders

STEEL SCREW PUNCHES, TUBE BRUSHES, &C.



Vertical and Yacht Engines.



THE ROWLAND VERTICAL ENGINE.

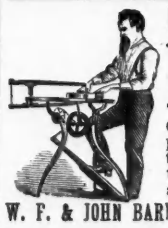
LARGE WEARING SURFACES.

Simple in Construction. Reasonable in Price.

Send for Circular.

F. C. & A. E. ROWLAND, Engineers,

NEW HAVEN, Connecticut.



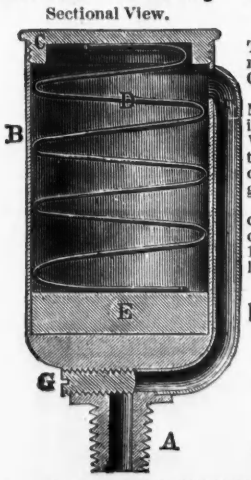
BARNES' FOOT POWER MACHINERY.

13 Different machines with which Builders, Cabinet Makers, Wagon Makers and Jobbers in miscellaneous work can compete as to **Quality and Price** with steam power manufacturing; also Amateurs' supplies. **Machines sent on trial.** Say where you read this, and send for catalogue & prices.

W. F. & JOHN BARNES, Rockford, Winnebago Co., Ill.

Loose Pulley Lubricator.

Sectional View.



The only reliable automatic Loose Pulley Oiler in the World.

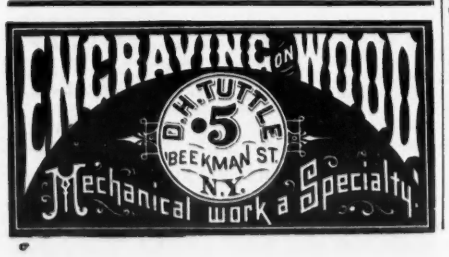
Saves Oil, Belting, Machinery, Time, soiling of Fabrics, &c., &c. Will run from one to three months with once filling. Gives general satisfactaction.

For illustrated description see April issue of American Machinist, 1879, or send for circular. Address

Loose Pulley Lubricator Mf'g Co.

P. O. Box 1030.

MIDDLETOWN, CT.



ROPER'S

Practical Hand-Books for Engineers.

STEPHEN ROPER,

Mechanical Engineer.

Hand-Book of Land & Marine Engines,	$3.50
Hand-Book of the Locomotive . . .	2.50
Hand-Book of Modern Steam Fire Engines	3.50
Cathechism of Steam Engines . . .	2.00
Use and Abuse of Steam Boiler . . .	2.00

The above books embrace all branches of Steam Engineering—Stationary, Locomotive, Fire and Marine. Any of them will be sent by mail, free of postage, on receipt of publication price. To any one ordering a full set, a liberal discount will be made, and if on examination the purchaser does not consider them worth $50.00 the money will be refunded.

Information by letter, when asked for, will be heerfully given to parties making inquiries about cientific Books, Steam Engines, Boilers, Steam amps, Injectors, or any kind of Steam Machinery.

Address,

STEPHEN ROPER,

447 North Broad St., Philadelphia

Newell's Patent Universal Grinder.

IMPORTANT TO MILLERS, MINERS AND MANUFACTURERS.

This Grinder is offered to the public as a machine which has no equal for grinding grain or pulverizing quartz, phosphates, bone, cement, oyster shells, scraps, glue, fire clay, and other articles of similar nature. It is unrivaled in the amount of work it will do in any given time and in the economy of power used. It is a point of great merit that our mill delivers a perfectly ***GRANULATED*** article. In grinding grain the meal ***IS NOT HEATED,*** and consequently may be bagged at the delivery spout with no danger of fermentation, and without the loss of weight incidental to the product when heated in grinding. It is estimated that the usual shrinkage is sufficient to cover the entire expense of grinding by this mill. We have ground, bolted for fine feed, through 13 mesh, weighed and bagged up ***six thousand five hundred (6500) pounds of corn per hour*** with not more than 15-horse power. It is compact, portable and not expensive. A cordial invitation is extended to all parties to call and see the machine at work at

Foot West 19th Street, New York City.

NEWELL & CHAPIN.

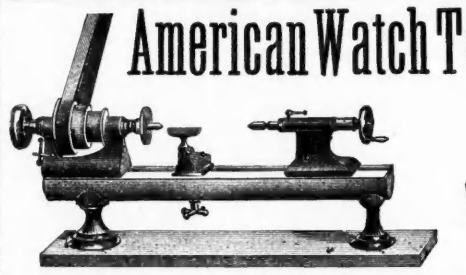
Important Tests of Machinery.

PARK BENJAMIN'S SCIENTIFIC EXPERT OFFICE,

with the aid of several eminent Engineering Experts, is conducting an extended series of Tests of Machine Tools, Safes, Metals, etc., in order to obtain new, impartial and accurate results for publication in *"Appleton's Cyclopædia of Applied Mechanics."* Manufacturers are entitled to receive full reports. Particulars on application.

Address PARK BENJAMIN'S SCIENTIFIC EXPERT OFFICE, 37 Park Row, New York.

American Watch Tool Co., Waltham, Mass.



MANUFACTURERS OF

MACHINERY

FOR

Watch and Clock Making,

AND

Special Tools and Machinery of all kinds.

The accompanying cut shows our No. 3, or Machinist Bench Lathe. This lathe was originally designed for the American Watch Co., and has been adopted by all American watch companies and by many clock companies of this country, and watch companies of England and Switzerland. All agree in pronouncing it the best lathe for small work ever made.

CLARK'S

Patent Rubber Castor & Truck Wheel

Especially desirable in Hotels, Warehouses, Mills, &c., being noiseless in their action, and saving all wearing away of floors.

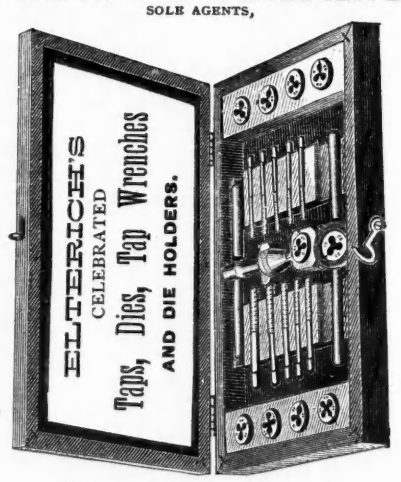
GEO. P. CLARK,

WINDSOR LOCKS, CONN.

Send for Price List and Circular.

FRASSE & COMPANY,

SOLE AGENTS,



62 Chatham Street,

P. O. Box 4627. NEW YORK.

PATTERN AND BRAND LETTERS.

PRICES REDUCED.

VANDERBURGH, WELLS & CO.

Printers' and Engravers' Warehouse,

Corner Fulton and Dutch Sts.,

NEW YORK.

JAMES W. SEE,

Consulting Engineer,

HAMILTON,

OHIO.

Engines Indicated and Examined.

POWER MEASURED.

W. H. ODELL, Practical Engineer.

P. O. BOX 274, YONKERS, N. Y.

N. B.—The application of the "Indicator" to an Engine (by an Expert) instantly detects any waste of power, or defect in the CONSTRUCTION or MANAGEMENT OF THE SAME, and often leads to a great saving of fuel.

Address P. O. Box 2187.

PIERSON & CO.

Office 24 Broadway, N. Y.

Established 1790.

IMPORTERS AND DEALERS IN IRON AND STEEL OF EVERY DESCRIPTION,

Warehouse, 24 and 26 Broadway, and 77 and 79 New Street,

PRICE LISTS FURNISHED ON APPLICATION.

WEEKLY REVIEW.

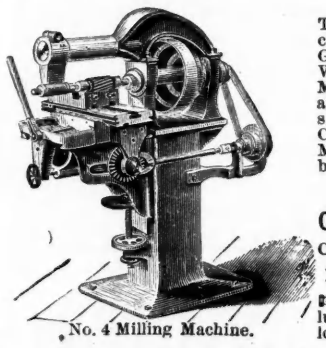
NEW YORK, JULY 26TH, 1879.

Iron and Steel, also Machinists' and Blacksmiths' Supplies continue in good demand, with prices unchanged. Railway Supplies continue in brisk demand and market firm. The rates out of store are as below: No. 1X Pig Iron $19.50 per ton; Iron Rails, $42.00 to $44.00 per ton, according to weight; Old Rails, $24.00 to $25.00 per ton; Fish Plates, $2\frac{2}{10}$c. per lb.; Railway Spikes, $2\frac{3}{4}$c. per lb.; Bolts and Nuts, $3\frac{1}{2}$c.; Common Iron, $1\frac{85}{100}$c. basis from store; Refined, $2\frac{1}{10}$c. basis; Ulster, $3\frac{1}{2}$c. basis; Machinery Steel, 5c.; Best Tool Steel, 12c.; Norway Bar Iron, $4\frac{3}{4}$c.; Norway Shapes, $5\frac{1}{4}$c.; Nail Rods, $5\frac{1}{2}$c.; Sheet Iron, $2\frac{6}{10}$c.; Angle Iron, $2\frac{4}{10}$c.; Tee Iron, $2\frac{8}{10}$c.; Band Iron, $2\frac{4}{10}$c.; Hoop, $2\frac{7}{10}$c., up; Horse Shoe, $3\frac{1}{10}$c.; Tank, $2\frac{6}{10}$c.; C No. 1, $2\frac{3}{4}$c.; C H, No. 1 Shell, 3c.; Best Flange, $4\frac{1}{2}$c.; Boiler Rivets, $3\frac{1}{2}$c. per lb. Hot Polished Shafting in lengths two feet and longer, from 5 to 6c. per lb., according to size. Small Black Rivets. 50% off in papers, 35% off in bulk.

PIERSON & CO., 24 BROADWAY.

FOR MACHINISTS' AND BOILER MAKERS'
HEAVY
Steel Clamps,
Send for Circular to
C. W. LeCount, South Norwalk, Ct.

E. E. GARVIN & CO.
Manufacturers of
Milling Machines, Drill Presses,

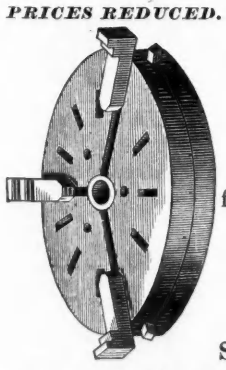


No. 4 Milling Machine.

Hand Lathes, Tapping Machines, Cutter Grinders and Wood Planers. Milling Cutters, all shapes and sizes. Gear Cutting and Milling in all its branches.
139-143
CENTRE ST.
Cornell's B'ld'g
NEW YORK.
☞ Send for illustrated Catalogue.

THE HENDEY MACHINE CO.
WOLCOTTVILLE, CONN., U. S. A.
MANUFACTURERS OF THE
Manville Patent Iron Planers and Shapers.
24 in. Shapers, 15 in. Shapers, 5 ft. x 24 in. Planers, 3½ ft. x 16 in. Planers, 24 in. Amateur's Hand-Planers, with Chuck and Centers, 3 ft. x 8 in. Fine Engine Lathes, 5 ft x 12 in. Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck and Common Clock Lathes.
☞ Send for Catalogue giving description of Tools, with names and opinions of users, and mention where you saw this.

OFFICE OF
The E. HORTON & SON CO.
PRICES REDUCED.



WINDSOR LOCKS, CONN.
APRIL 1st, 1879.
From this date a discount of 30 per cent. will be made from the price list of our Lathe Chuck.
Soliciting your orders, we are
Yours respectfully,
THE E. HORTON & SON CO.
Send for Price List.

Model Engines.

Complete sets of CASTINGS for making small
Model Steam Engines, 1 1-2 in. bore, 3 in. stroke, price, $4: ditto, 2 in. bore, 4 in. stroke, price, $10, same style as cut. Gear wheels and parts of Models. All kinds of small Tools and Materials. Catalogue free. GOODNOW & WIGHTMAN, 176 Washington Street, Boston, Mass.

PATENTS.
HENRY E. ROEDER,
304 Broadway, New York.
ESTABLISHED 1852.
Patents procured in the U.S. & Europe.

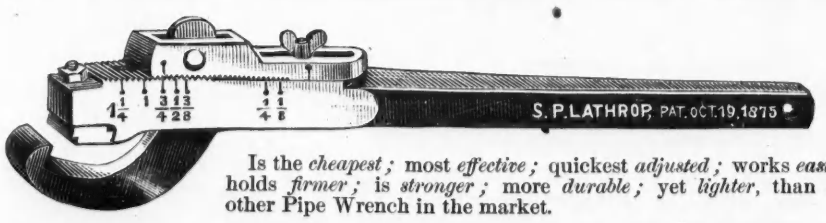
N. B.

The following original articles, by twelve of the best mechanical authors in the U. S., appeared in the *American Machinist* of the dates mentioned below. Copies containing these articles can be ordered from any newsdealer at 6 cents each.

Sizes of Safety Valves.
Prof. R. H. Thurston. December, 1877.
Methods of Setting Boilers in Brick-Work.
Theron Skeel. December, 1877.
Boiler Explosions.
Stephen Roper. April, 1878.
Strength of Steam Boilers.
John W. Hill. July, 1878.
The Properties of Water.
John W. Hill. August, 1878.
Balancing Pulleys.
Geo. M. Chordal. August, 1878.
Piston Speed of Engines.
Wm. Lee Church. September, 1878.
Composition of Fuel.
John W. Hill. September, 1878.
To Prepare a Shaft Properly for Turning.
J. J. Grant. October, 1878.
Practical Method of Setting the Valves of a Locomotive.
L. F. Lyne. November, 1878.
Boring Locomotive Cylinders.
L. F. Lyne. December, 1878.
Grinding and Polishing Metal Surfaces by Hand.
Thos. Hagerty. December, 1878.
To Turn a Shaft Properly.
J. J. Grant. December, 1878.
Engineering Popularized.
Wm. Lee Church. January, February, March, Apr and May, 1879.
Calculated vs. Actual Engine Duty.
W. H. Odell. January, 1879.
The Injector as a Means of Raising Water.
Wm. J. Williams. February, 1879.
Engine Duty and Indicator Cards.
Chas. A. Hagne. April, 1879.

TOOL DEPOT: SMALL TOOLS, LATHES &c. FOR MACHINISTS, CARPENTERS, AMATEURS & EVERY BRANCH OF MECHANICAL TRADE. SEND FOR CATALOGUE. TALLMAN & McFADDEN, PHILADELPHIA

PRICES REDUCED.
THE VICTOR PAT. ADJUSTABLE PIPE WRENCH.



Is the *cheapest;* most *effective;* quickest *adjusted;* works *easier;* holds *firmer;* is *stronger;* more *durable;* yet *lighter,* than any other Pipe Wrench in the market.
EVERY WRENCH GUARANTEED.
No. 1 Wrench takes from 1-8 to 1¼ Pipe.
PRICE $3.00, NET.
S. PARK LATHROP,
200 MARKET STREET, - - - NEWARK, N. J.

ALMOND DRILL CHUCK
Made of Steel throughout, equal to doing any work required of it—Runs perfectly true. Cost but $5.
T. R. ALMOND
84 Pearl St.
BROOKLYN.
(Cut shows Chuck full size.)

JOHN ADT,
20, 22, 24 and 26 Artisan St., New Haven, Ct., U.S.
Automatic Machines,
For Straightening and Cutting Wire of all Sizes to any Length.
Automatic Machines for cutting and forming wire in various shapes. Send for circulars.

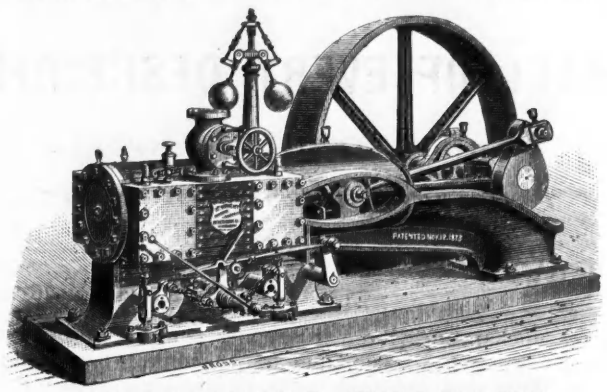
WONDERFUL
PUNCHING.
D. L. KENNEDY'S
Spiral Shearing Punch.
THE
DRILL
AND REVOLVING CUTTER
SUPERSEDED,
AND THE WORK
2½ TONS PER SQUARE INCH
STRONGER than with the FLAT PUNCH.
Can be used in any Punching Machine, by license from the patentee.
D. L. KENNEDY,
10 Cortlandt St., New York.
CAUTION.—Infringements will be rigorously prosecuted.

Patent Automatic Cut-off Steam Engine.

WM. WRIGHT,

PATENTEE AND BUILDER, NEWBURGH, N. Y.

THE MOST ECONOMICAL IN THE USE OF FUEL, THE SIMPLEST IN CONSTRUCTION, AND ALTOGETHER THE BEST CUT-OFF ENGINE IN THE MARKET.



COMPOUND ENGINES

For City Water Works; also for Manufacturing purposes, etc. (*Highest duty guaranteed.*)

MARINE AND STATIONARY ENGINES.

STEAM BOILERS AND TANKS,

LIGHT AND HEAVY FORGINGS, SHAFTING, PULLEYS, HANGERS, MILL WORK, IRON AND BRASS CASTINGS, &c.

A LARGE GENERAL ASSORTMENT OF PATTERNS ON HAND.

THE "BROWN"

AUTOMATIC CUT-OFF ENGINE,

MANUFACTURED ONLY BY

C. H. BROWN & CO.

FITCHBURG, MASS.

Forged & Twisted Machinists' Drills.

By an improved process of manufacture warranted to do more work than any other drill in market with less liability to injury.

N. Y. TWISTED DRILL CO.

240 Plymouth St., Brooklyn, N. Y.

P. BLAISDELL & CO.

MANUFACTURERS OF

Machinists' Tools,

Worcester, MASS.

TRADE GODDARD MARK

THE

Goddard Emery Wheel,

E. A. GODDARD,

Gen. Sales Agent.

ALSO AGENT FOR

AMERICAN TWIST DRILL CO'S

Emery Grinders.

DEALER IN

MACHINISTS' SUPPLIES.

Warerooms, 176 FULTON STREET, NEW YORK.

JARVIS PATENT FURNACE

FOR SETTING

STEAM BOILERS.

Economy of Fuel, with increased capacity of Steam Power

The same principle as the SIEMANS' PROCESS OF MAKING STEEL, *i. e.*, utilizing the waste gases with hot air.

Will burn all kinds of waste fuel without a blast, including screenings, wet peat, wet hops, sawdust, logwood chips, horse manure, &c.

A. F. UPTON, General Agent,

Send for Circular. P. O. BOX 3401, BOSTON, MASS.

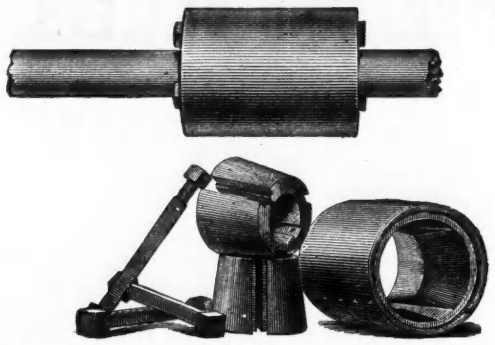
ESTABLISHED 1848.

WILLIAM SELLERS & CO.

PHILADELPHIA.

Machine & Railway Shop Equipments

Shafts,
Couplings,
Hangers,
Pulleys,
Mill Gearing,
Etc.



Lathes,
Planers,
Drills,
Shapers.
Bolt Cutters,
Etc.

Railway Turntables and Pivot Bridges,

GIFFARD INJECTORS. SELLERS' IMPROVEMENTS

NEW PATTERNS. SIMPLE, EFFECTIVE.

New York Office, 79 Liberty Street.

The Consolidated Safety-Valve Co.

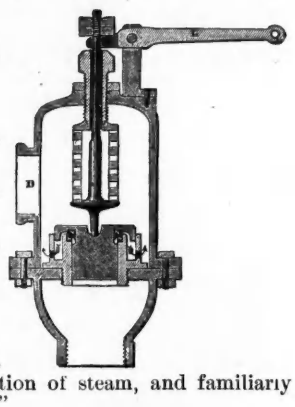
51 and 53 Sudbury Street, Boston.

Capital, $100,000.

CHAS. A. MOORE,
Pres. and Gen'l Manager,
MARTIN LUSCOMB,
Treas. and Secretary,
GEO. W. RICHARDSON,
Superintendent.

Sole Owners of all Safety-Valve Patents granted to

E. H. ASHCROFT, Boston, Mass.
AND
GEO. W. RICHARDSON, Troy, N. Y.



These Patents cover all Safety-Valves utilizing the recoil action of steam, and familiarly known as "Pop Safety-Valve."

☞ *Purchasers, beware of infringements of our Patents.* ☜

MIDVALE STEEL WORKS,

NICETOWN, PHILADELPHIA.

Manufacturers of all Kinds of

Hammered and Rolled Steel,

BEST WARRANTED CAST STEEL

For Machinists' Tools, Taps, Punches, Dies, Drills. Chisels, Shear Blades and Granite Drills.

ALSO,

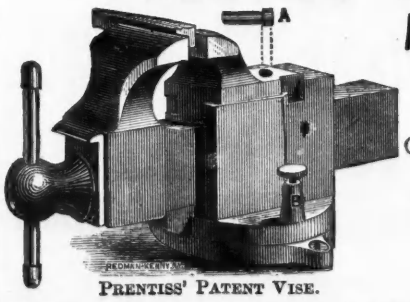
Machinery, File, Fork, Hoe and Spring Cast Steel.

Address A. M. F. WATSON,

General Sales Agent.

Warehouse, 12 North 5th Street, Philadelphia.

PRENTISS' PATENT VISES.



PRENTISS' PATENT VISE.

Adjustable Jaw, Stationary

AND

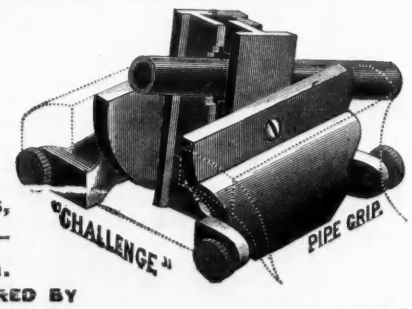
SWIVEL BOTTOM.

Complete without Attachments. Adapted to all classes of vise work.

"CHALLENGE" PIPE GRIP.

ADJUSTABLE (*PAT.* 1879),

Enabling operator to hold Pipes, Couplings, Thimbles, &c., in a Vertical, Slanting, or Horizontal position.



MANUFACTURED BY

BAGLEY & SEWALL, General Machinists, Watertown, N.Y.

FOR

HALL MANUFACTURING CO.

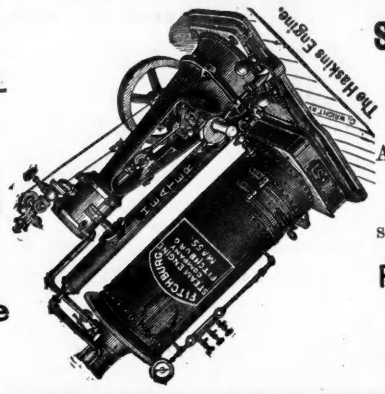
Send for Circular. *23 DEY STREET, N. Y.*

A. F. CUSHMAN,
Hartford, Ct., U. S. A.

CHUCKS

Manufacturer of the largest variety of Chucks in the world.
Agents wanted

HORIZONTAL,
VERTICAL
Automatic Cut-off
ENGINES.
Yacht Engines,
Semi-Portable
Engines.



STEEL AND IRON
BOILERS.

All sizes to 225 horse-power.

Send for pamphlet and say where you saw this.

FITCHBURG STEAM ENGINE CO.
Fitchburg, Mass.

A PRACTICAL TREATISE
ON THE
COMBUSTION OF COAL.
Including Descriptions of various Mechanical Devices, for the Economic Generation of Heat by the Combustion of Fuel, whether SOLID, LIQUID, OR GASEOUS.
BY
WILLIAM M. BARR.
1 Vol., large 8vo., illustrated.
Price, Extra Cloth, - - - - - $4.50
" Half Morocco, - - - - 3.50
Sent, postage paid, to any part of the United States upon receipt of the price. Address
JOHN BROTHERS, Publishers, Indianapolis, Ind

A NEW BOOK.

Friction AND Lubrication.

Determination of the laws and coefficients of Friction by new methods and with new apparatus, by ROBERT H. THURSTON, A. M., C. E., Professor of Mechanical Engineering at the Stevens Institute of Technology; Member of the American Society of Civil Engineers; American Institute of Mining Engineers; Fellow of N. Y. Academy of Science, etc., etc.

The author of this book has long been a student and independent investigator of the laws of friction, and of the effects of lubrication and different kinds of lubricants, and has aimed to present here a complete abstract of existing knowledge on the subject.

He discusses at length, and with such illustrations as are necessary:

Rolling Friction on Roads and Railroads; Frictional Resistance of Railroad Trains; Friction of Cordage, Fluids, Journals, Brakes, Rails, Belts, Pump Pistons, Mill Shafting, etc., etc.; Morin's, Coulomb's, Ammonton's, Rennie's and other experiments; Lubrication and the different kinds of Lubricants in use, their characteristics, composition and effects; Limits of Pressure; Size of Journals and methods of oiling them; Testing Lubricants; Identification of Oils, their classification, composition, alterations of composition, mixtures, specific gravity, density, effects of heat, gumming, drying, etc., etc.; Impurities of Mineral Oils; Oleography, cohesion figures; Chemical tests; General Methods of Analysis; Preparation and use of Re-agents; Reactions; Metcalfe's Experiments; Methods of Testing Lubricants; Thurston's Apparatus and Experiments; Friction under varying pressure and with varying velocities; Commercial value of Lubricants and many other kindred subjects.

The book contains many tables for ready reference, and engravings of the different kinds of testing apparatus.

Price, postage prepaid. $1.50. Published and for sale by

THE RAILROAD GAZETTE,
73 Broadway, New York.

☞ Send for Catalogue of Railroad Gazette Publications.

LARGE AND FRESH STOCK
—OF—
Second-Hand Tools.

PRATT & WHITNEY CO. TOOLS.

ALL GOOD AS NEW.

One Hand Lathe, 15 in. x 8 ft.
One Cutting-off Lathe, 1⅛ hole through Spindle.
One Upright Drill, 24 in. with bk. gear and self feed.
One No. 0, 2 Spindle Drill.
Two No. 0, 3 " "
One No. 1, 3 " "
One No. 3, 4 " " 2 Spindles geared for heavy work.
One No. 1, Power Milling Machine.
Two No. 2, or Lincoln Pattern Milling Machine.
One No. 2, Hand Milling Machine.
One Cutter Grinder.
One No. 3, Screw Machine.
One No. 2, Screw " Plain.
One No. 2, " " wire feed.
One Screw Slotting Machine.
One Double Cam Cutting Machine.

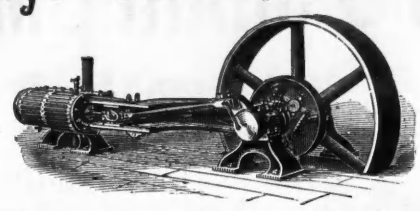
WOOD, LIGHT & CO.'S TOOLS.

One 25 in. x 12 ft. Engine Lathe, bk. geared, screw cutting, rod feed, cross feed, etc.
Four 20 in. x 8½ ft. Engine Lathes, bk geared, screw cutting, rod feed, gib rest, face plate, countershaft.
One 18 in. x 10 ft. ditto.
Three 18 in. x 8½ ft. "
Four 16 in. x 8 ft. "
Six 16 in. x 6 ft. " (W't rest).
One 16 in. x 6 ft. " (Gib rest).
One 16 in. x 5½ ft. " (W't rest).
One 16 in. x 10 ft. Gib rest, rod feed, (not screw cutting).
One 24 x 24 in. x 6 ft. Planers, down, cross and angle feed in the head.

[Works.
One Engine Lathe, 20 in. x 12 ft. Lambertville Iron
One " " 18 in. x 10 ft. Star Tool Co. New.
One " " 18 in. x 9 ft.
One " " 16 in. x 8 ft. Fifield, new.
One " " 16 in. x 5 ft. Good order.
Four " " 14 in. x 4½ ft. Putnam Mch. Co.
One " " 7 in. x 36 in. Ames.
Hand Lathes, from 7 to 15 in. Swing.
One Planer 48 x 48 in. x 16 ft. Good order.
One " 30 in. x 7 ft.
One " 30 in. x 7 ft. Putnam.
One " 30 in. x 7 ft., new. Stover.
One " 26 in. x 6½ ft. Putnam.
One " 16 x 3 ft., good order, Pratt & Whitney.
One Crank Planer, 24 in. stroke.
One " " 12 " "
One Shaping Machine, 8 in. stroke. N.Y.S.E.Co., new.
One Wood & Light Milling Machine.
One Brainard Milling Machine, No. 8.
Seven Lincoln Pattern Milling Machines.
One Smith & Garvin No. 3. Miller. New.
Two Pond's Index Milling Machine.
One Smith & Garvin Hand Milling Machine.
Two 4 spindle Drills. Ames Mf'g. Co.
Four Sensitive Drills, drills to 3-16 in. hole.
One 20 in. Upright Drill.
One 2-Spindle Profile Machines.
One Suspension Drill. Bk. Geared, Self-Feed.
One Sellers' Bolt Cutter. Cuts to 1¼ in.
One Hor. Trav. Drill, 32 in. swing, 10 ft. bed.
One Rotary Shear for sheet metal.
One 1500 lb. Steam Helve Hammer for Axles.
One Axle Centering Machine.
One 300 lb. Ferris & Miles Steam Hammer.
One Bement Hor. Boring Mill.
One 28 in. x 60 in. Harris Corliss Engine.
One 7 in. x 12 in. Whitehill & Smith Engine.
One 10 H.P. Baxter Engine.
One 2 " "

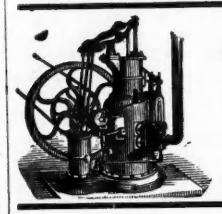
E. P. BULLARD,
14 Dey Street, New York.

The Buckeye Automatic Cut-off Engine.



Estimates Furnished on Application.

BUCKEYE ENGINE CO.
Room 42, Coal and Iron Exchange, New York.
HILL, CLARKE & CO., - - - 36 & 38 Oliver Street, Boston.



AIR ENGINES. NO WATER. NO ENGINEER.
No Extra Insurance! Absolutely Safe! Simple! Reliable! Durable!
Most Convenient and Economical Power Known.
SHERRILL ROPER AIR ENGINE CO.
Manufacturers of Air Engines, Elevators and Hoisting Machinery.
91 & 93 Washington St., N. Y.

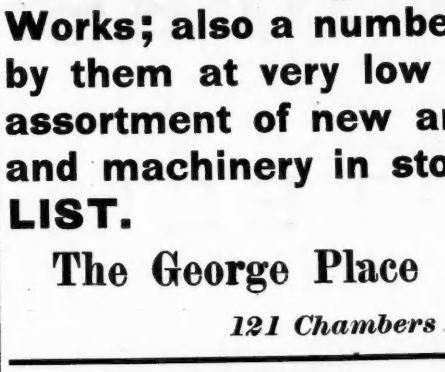
The George Place Machinery Agency

Offer for sale all the second-hand tools of the Wood & Light Machine Co., at their Works; also a number of new tools made by them at very low prices; also a large assortment of new and second-hand tools and machinery in stock. SEND FOR A LIST.

The George Place Machinery Agency,
121 Chambers & 103 Reade Sts., New York.

DOWNER'S
Anti-Incrustation Liquid
FOR THE PREVENTION AND REMOVAL OF SCALE IN STEAM BOILERS,
Is a Chemically Scientific Preparation,
SAFE, EFFECTIVE AND ECONOMICAL.
Used in new or clean boilers scale cannot form, as scale producing constituents are neutralized.
IN BARRELS AND HALF BARRELS.
Circulars on application.
A. H. DOWNER,
(Proprietor and Sole Manuf'r.)
17 PECK SLIP, N. Y.

BINDERS FOR THE
American Machinist.

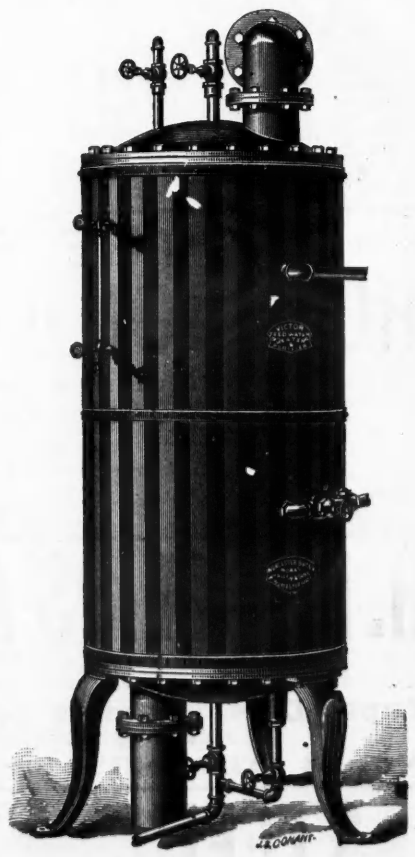


We are now prepared to offer to our readers who wish to preserve files of the paper, the **MONITOR BINDER**, shown in the above cut which we have selected as the best one offered to the public. The price for neat cloth covers, to hold 52 numbers (1 year), with the name **American Machinist** stamped on the front (outside), will be $1.00 each, mailed post paid in the United States and Canada, and 75 cents each delivered at our office.

American Machinist Publishing Co.
96 Fulton Street, N.Y.

MOORE'S "UNIVERSAL ASSISTANT AND COMPLETE MECHANIC," enlarged edition, contains 1016 pages, 500 Engravings, 461 Tables, over 1,000,000 Industrial Facts, Calculations, Processes, Rules, Trade Secrets, &c., in every Occupation. A $5 book free by mail for $2.50, worth its weight in gold to any Mechanic, Farmer, or Business man. *Agents Wanted.* One Agent reports only one refusal in obtaining 35 orders. An ad. is utterly inadequate to describe the work. For Ill. Pamphlet send stamp to R. Moore, No. 20 Cooper Inst., New York.

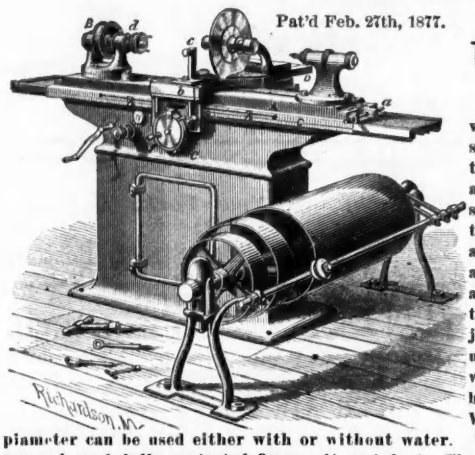
Worcester Boiler Works,
MANUFACTURERS OF THE
"VICTOR"
Feed-Water-Heater and Purifier,
FOR
HEATING AND PURIFYING WATER
FOR STEAM BOILERS.



(Jones' Patent, Nov. 6, 1877.)
WM. ALLEN & SONS
WORCESTER, MASS.
☞ Write for prices and further information.

BROWN & SHARPE MFG. CO.

Providence, R. I.



Pat'd Feb. 27th, 1877.

MANUFACTURERS OF THE

Universal Grinding Machine.

This Machine is arranged for doing a large variety of operations of grinding, by the use of solid emery or corundum wheels. An additional movable table, capable of adjustment by a tangent screw and graduated arc, admits of straight and curved taper grinding with the centers of the machine always in line. It is specially adapted for grinding soft or hardened spindles, arbors, cutters, either straight or angular, reamers and standards also for grinding out straight and taper holes, standard rings, hardened boxes, jewelers' rolls, &c. The work can be revolved upon dead centres or otherwise. The grinding wheel can be moved over the work at any angle by which means any taper can be produced. Wheels from one-quarter inch to twelve inches in piameter can be used either with or without water. The feed works and slides of the machine are covered, and fully protected from grit and dust. The grinding of taper holes and angular cutters is provided for with graduated arcs. A special chuck, for holding work for having holes ground, accompanies each machine. The spindle and boxes of the machine are of cast steel hardened and ground. Distance between centers, 28 inches; will swing 12 inches diameter.

NEWARK
Steel Works.

BENJAMIN ATHA & CO.

Manufacturers of

CAST STEEL.

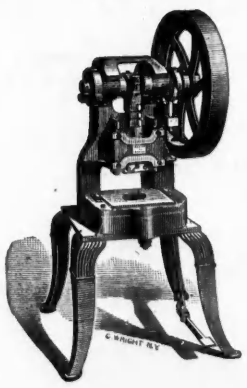
We make grades of Steel specially adapted to the manufacture of Lathe Tools, Chisels, Taps and Dies.

NEWARK,

NEW JERSEY.

BENJ. ATHA. J. ILLINGWORTH.

GOLD MEDAL AWARDED PARIS EXPOSITION, 1878.



BLISS & WILLIAMS,

MANUFACTURERS OF ALL KINDS OF

Presses, Dies and Special Machinery

FOR WORKING SHEET METALS, &c.

FRUIT AND OTHER CAN TOOLS.

167 to 173 Plymouth St., cor. Jay, Brooklyn, N. Y.

Catalogues in English, French and German sent on application, in which prices are computed in Dollars, Pounds, Francs and Reichsmarks.

Established THE FAMOUS 1866

HUNTOON STEAM GOVERNOR

INSURES A DIRECT SAVING IN STEAM OF FROM 10 TO 20 PER CENT. OVER ANY OTHER GOVERNOR KNOWN, WHILE FOR QUICK AND ACCURATE REGULATION, GREAT DURABILITY AND LASTING ECONOMY IN USE, THIS IS FAR IN ADVANCE OF ALL OTHERS.

Largely in use by U. S. Government, also by leading Manufacturers in all classes of Work.

Circulars mailed on application to

HUNTCON GOVERNOR CO., Lawrence, Mass.

H. PRENTISS AND COMPANY

Manufacturers of PATENT RELIEVED

Machinists', Blacksmiths' and Gas Fitters'

Taps; Dies, Reamers and Screw Plates, &c., &c.

DEALERS IN MACHINISTS' SUPPLIES.

No. 14 DEY STREET, - NEW YORK.

STEEL CASTINGS

FROM 1-4 TO 10,000 lbs. WEIGHT.

True to pattern, sound and solid, of unequalled strength, toughness and durability.
An invaluable substitute for forgings or cast iron requiring three-fold strength.
Gearing of all kinds, Shoes, Dies, Hammerheads, Crossheads for Locomotives, etc.
12,000 Crank Shafts of this steel now running proved superior to wrought iron.
CRANK SHAFTS, CROSSHEADS and GEARING specialties.
Circulass and Price Lists free. Address

CHESTER STEEL CASTINGS CO.

Works, CHESTER, Pa. | 407 Library St., PHILADELPHIA

THE PRATT & WHITNEY CO.

HARTFORD, CONN., U. S. A.

MAKE SPECIALTIES OF

Drop Hammers,

PUNCHING PRESSES,

HAND DRILLING MACHINES, RATCHET DRILLS, COMBINATION LATHE CHUCKS, CUTTERS FOR TEETH OF GEAR WHEELS, SCREW PLATES, HAND, MACHINE NUT AND PIPE TAPS, AND BOLT CUTTERS,

In connection with their business of

MACHINISTS' TOOLS, GUN, SEWING MACHINE and Special Machinery, &c.

PRICE LISTS FURNISHED ON APPLICATION.

THE BILLINGS & SPENCER CO.

CHAS. E. BILLINGS, Pres't and Sup't. TRADE B MARK. E. H. STOCKER, Secretary.
L. H. HOLT, Treasurer.

HARTFORD, CONN., U. S. A.

MANUFACTURERS OF

Billings' Adjustable Pocket Wrench.

Billings' Adjustable Tap & Reamer Wrenches,

PATENT SCREW PLATES AND DIES,

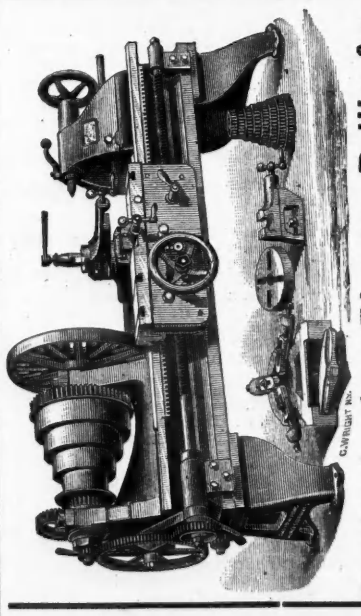
WROUGHT IRON AND STEEL, DROP FORGED LATHE DOGS, SCREW DRIVERS, AND SOLID FORGED SEWING MACHINE SHUTTLES. Also, PACKER RATCHET DRILLS, BARWICK WRENCHES, &c., and all descriptions of

STEEL AND IRON DROP FORGINGS

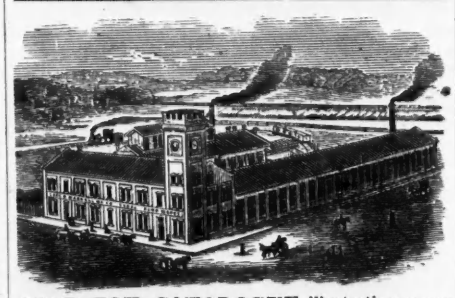
For Guns, Pistols, Sewing Machines, Machinists' Tools and Machinery Generally. Send for illustrated Catalogue and Price List.

Manufacturer of **TAPS AND DIES** of every description.

Also, for sale low, **UNITED STATES STANDARD GAUGES**, from ¼ to 3 inch.



Engine Lathes, Planers, Drills, &c.
DAVID W. POND, WORCESTER, MASS.
Send for Catalogue.



SEND FOR CATALOGUE illustrating every variety of

STEAM PUMPING MACHINERY.

COPE & MAXWELL MF'G CO.

HAMILTON, OHIO.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

J. M. ALLEN, President.
W. B. FRANKLIN, Vice-President.
J. B. PIERCE, Secretary.

Engine Lathes,

Send for photographs and prices to

GEO. W. FIFIELD,

LOWELL, Mass.

Machines at reduced prices, and Wheels *Guaranteed.*

LEHIGH VALLEY EMERY WHEEL CO.

Send for our new Illustrated Catalogue *Weissport, Penn.*